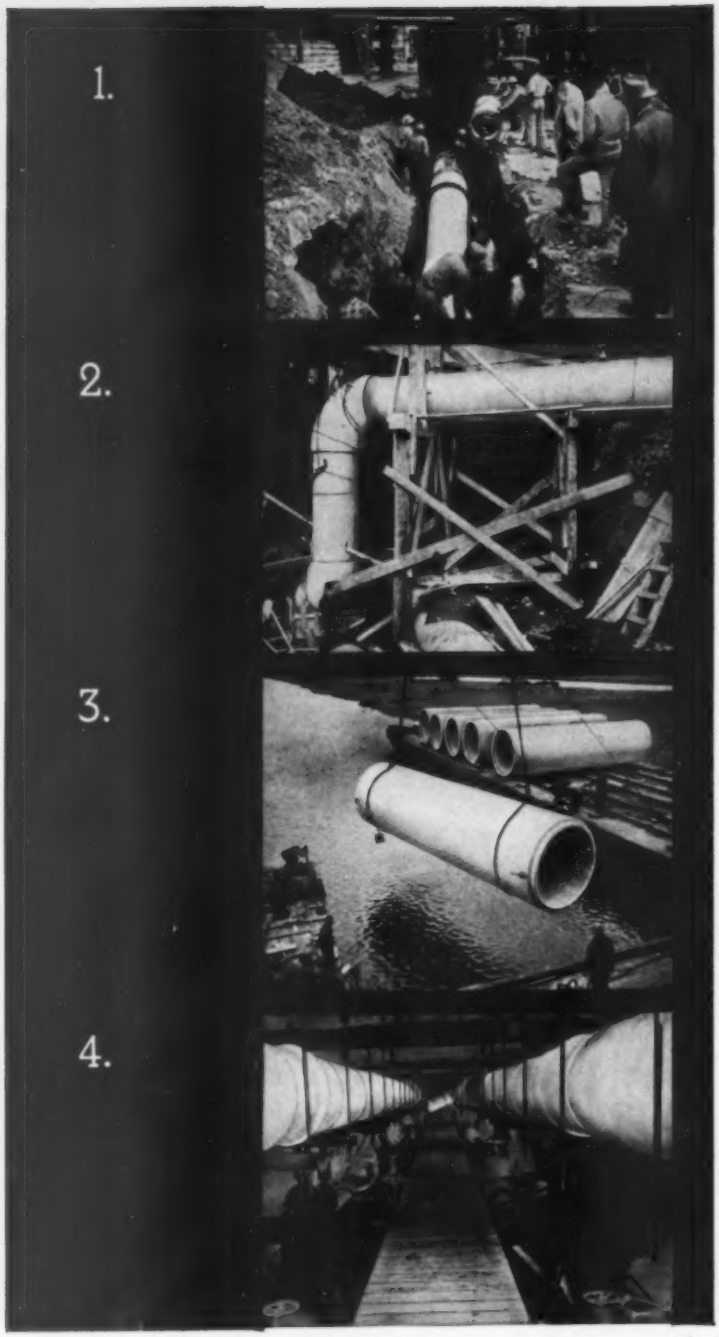
WATER & SEWAGE WORKS

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL



LOCK JOINT

the multi-purpose pressure pipe

Lock Joint Concrete Pressure Pipe has long been recognized as the ideal, high capacity pipe for water supply lines, but its variety of types and designs has also permitted successful use in the following:

- WATER DISTRIBUTON SYSTEMS
- INDUSTRIAL PLANT INSTALLATIONS (Supply, circulating and cooling systems)
- SUBAQUEOUS INSTALLATIONS (Water intakes, siphons and sewer outfalls)
- WATER WORKS PLANTS (Pumping and treatment plant piping)
- SEWAGE OPERATIONS (Force mains and plant piping)

THESE are some of the major services for which Lock Joint Concrete Pressure Pipe is ideally suited. So, if your pressure pipe problem involves pipe 16" in diameter or larger, call on Lock Joint – the low cost, high capacity, long lasting multi-purpose pipe.

SCOPE OF SERVICES—Lock Joint Pipe Company specializes in the manufacture of Reinforced Concrete Pressure Pipe for Water Supply and Distribution Mains 16" in diameter or larger, as well as Concrete Pipes of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous Lines.

LOCK JOINT PIPE COMPANY

Established 1905

P. O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich., Columbia, S. C.

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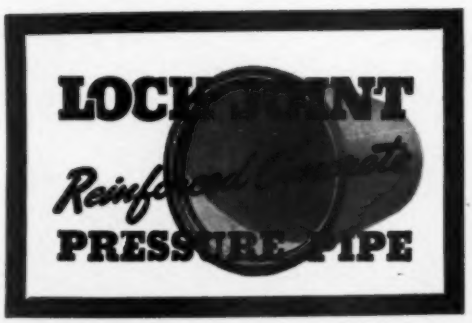

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How much for maintenance?

In figuring the cost of a trash pump, what do you allow for maintenance . . . how much to clear out the trash that clogs the impeller? Will it be daily? Every other day? Weekly?

Or figure it this way. What price a pump that won't clog . . . that will virtually eliminate maintenance? That's why you should figure the Fairbanks-Morse Bladeless Impeller Pump! Its unique whirling tube won't clog . . . there are no blades or projections to catch and hold trash.

This is just one more example of the quality that is Fairbanks-Morse . . . in design, materials, workmanship, a standard of quality that gives you more for your pump dollar. For pump performance you can depend on, rely on the world's largest manufacturer of a complete pump line. See your Fairbanks-Morse Branch or write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

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a name worth remembering when you want the best

PUMPS • SCALES • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY • RAIL CARS • HOME WATER SERVICE EQUIPMENT • FARM MACHINERY • MAGNETOS

IS PURE • TASTELESS • ODORLESS

Your community is interested in *more* than just pure water. Local sanitation engineers are often faced with problems of disagreeable tastes and odors which cannot be controlled by regular water treatment methods.

Today, over 150 communities are using the Mathieson Chlorine Dioxide process to eliminate unpleasant tastes and odors. Chlorine dioxide is not only a dependable disinfectant, but its powerful oxidizing action...

- destroys tastes and odors from algae and other organic matter
- changes manganous salts to insoluble manganic compounds
- oxidizes objectionable compounds formed during regular chlorination
- helps maintain an active chlorine residual throughout distribution system
- is effective in even highly alkaline and softened water

Treatment of potable water with Mathieson Chlorine Dioxide is neither complicated nor expensive and it requires only the simplest of equipment. And Mathieson's comprehensive technical service is a PRODUCT-PLUS that assures you of a system best suited to your needs. Get complete information from your Mathieson representative or write today.

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Mathieson Industrial Chemicals Division
Baltimore 3, Maryland

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WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT

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In two continuing series of articles
"WATER WORKS PRACTICES" are discussed by *Dr. George Symons*
"SEWAGE WORKS PRACTICES" are discussed by *Prof. Don Bloodgood*

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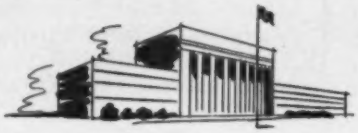
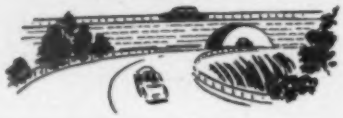


$6,750,000,000 of new schools annually for the next 10 years!*



$8,000,000,000 of new highways annually for the next 10 years!*

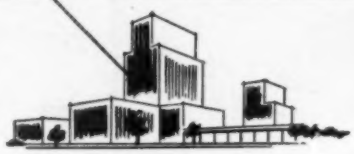
$1,800,000,000 of water and sewerage facilities annually for the next 5 years!*

America's community needs

...they can be met now

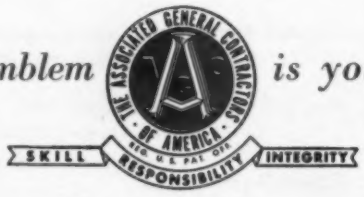
The construction industry *now more than ever* has the capacity and experience to build these needed facilities quickly, efficiently and economically.

The general contractor who displays the A. G. C. emblem has the proven Skill, Integrity and Responsibility to execute and coordinate the construction operations.



$1,500,000,000 of new hospitals annually for the next 10 years!*

*Minimum annual community needs as reported to the Congress by the President in his Economic Report, January 28, 1954

The A.G.C. Emblem 

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America Progresses Through Construction . . . Construct by Contract!

Lithographed on stone for U. S. Pipe and Foundry Co. by John A. Noble, A. N. A.

CAST IRON PIPE being unloaded as shown above may be for use in the city's water, gas or sewerage system. The more-than-a-century service record of cast iron pipe in this country is a strong reminder that the installation of this pipe will be not only for the benefit of the present generation but for many more to follow.

U. S. cast iron pipe, centrifugally cast in metal molds, retains the good characteristics of the older type of pipe and incorporates the superior properties of strength and uniformity imparted by this modern casting process and quality controls.

We are well equipped to furnish your requirements for cast iron pipe and fittings made in accordance with American Standard, American Water Works Association and Federal specifications. U. S. pipe centrifugally cast in metal molds is available in sizes 2- to 24-inch and pit cast pipe in the larger sizes.

U.S.
cast iron
PIPE

United States Pipe and Foundry Co.,
General Office, 3300 First Ave., N. • Birmingham 2, Ala.
Plants and Sales Offices Throughout the U. S. A.

17-mile water line to supply City of Colorado Springs, being laid in high terrain near Florissant, Colo. Bethlehem supplied a total of 4000 tons of steel pipe for this project. *Contractor:* Hutcheson Construction Co., Denver; *Consulting Engineers:* Black & Veatch, Kansas City, Mo.

High-Strength Steel Pipe Saves $222,000 on 17-Mile Water Line

The City of Colorado Springs, Colo., saved taxpayers a barrel of money in laying this new 30-in., 17-mile-long water line by using high-strength Bethlehem steel pipe at points of extreme stress.

In areas of normal water pressure Bethlehem Tar-Enameled Pipe in the standard grade of carbon steel with a yield point of 30,000 psi was entirely satisfactory. But the line was laid over a rugged terrain, and at some locations the water pressures ran as high as 800 psi. Standard carbon-steel pipe used under such pressures would have required walls as thick as ⅞ in., resulting in excessively heavy pipe, prohibitive in cost and difficult to handle.

The design engineers found the answer in using two grades of high-strength steel pipe in high-pressure locations: (1) Pipe of special carbon steel, with a minimum yield point of 42,000 psi; and (2) Pipe of Bethlehem's low-alloy Mayari R, with a minimum yield point of 50,000 psi.

In this way wall thicknesses were kept down to a range of from ¼ in. to ½ in., and total steel requirements for the line were reduced by approximately 1800 tons, a saving in steel alone of $222,000!

This saving in weight also meant lower shipping and welding costs, and greatly simplified handling in the field.

If you have a water-line problem involving high heads, perhaps you could use a high-strength grade of Bethlehem Tar-Enameled Steel Pipe to advantage. Bethlehem pipe comes in all diameters from 22 in., to the largest permitted by common carriers, and in any wall thickness required, for any water- or sewage-carrying application. It is readily joined in the field by welding, mechanical couplings, or riveting. Straight lengths are generally furnished 40 ft long.

Every Section of Bethlehem Steel Pipe Is Tested In Accordance with AWWA Specifications

This hydrostatic test is, in most cases, equivalent to 200 pct of the working pressure, assuring you that Bethlehem Steel Tar-Enameled Water Pipe meets AWWA requirements for strength and water-tightness.

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BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM *Tar-Enameled* STEEL PIPE

LOOKING FOR A SLOW, STEADY SOURCE OF CHLORINE?

USE HTH TABLETS

The unique properties of HTH Tablets make them the ideal chlorine carrier for many applications. When added to water, the HTH Tablets go to work immediately, but instead of creating a momentary high chlorine residual which may be rapidly dissipated, they provide a steady supply of available chlorine over a long period. Thus, they are most practical and economical where a chlorine residual must be maintained.

Currently, HTH Tablets are finding application in the following important sanitation jobs:

- Sanitizing newly laid pipe lines and new wells.
- Destroying algae; controlling bacterial growth in spray ponds, reservoirs, basins, etc.
- Disinfecting swimming pool water.
- As a sanitizing agent and algaecide for use in sand filters.
- Destroying offensive odors originating in stagnant ponds, ditches, etc., especially those subject to seepage from septic tanks.
- Preventing the breeding of mosquitoes, flies and other insects.
- Miscellaneous sanitation, deodorization and similar uses.
- Sewage disposal plants—disinfecting of effluents, odor control, B.O.D. reduction.

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MATHIESON CHEMICAL CORPORATION
Mathieson Industrial Chemicals Division
Baltimore 3, Maryland

Containing not less than 70% available chlorine, HTH Tablets are easy to use and completely safe. They are packed in 100-lb. metal drums and convenient cases of nine 7½-lb. cans.

HTH TABLET HYPOCHLORINATION

Write for full information on this efficient new chlorination method.

2357

There's no customer

Ewing Galloway

This is Detroit—the Automotive Capital of the World.

Bettmann Archive

Old print showing Detroit about a century ago, from the Canadian side of the river.

MODERNIZED cast iron

like an old customer!

DETROIT installed cast iron water mains 116 years ago... and installs them today!

One hundred years ago, Detroit was a city of 40,000. Today it is the Automotive Capital of the World. Today's two million population (estimated) requires over three thousand miles of mains of which 97% are cast iron. Several of these mains are still functioning after a century and more of service. Customers served have increased from 5300 a century ago to nearly 400,000 (city only).

When you have customers with an unbroken record of buying your product for over a century, you naturally prize them. They're scarce in any long-established business or industry. The cast iron pressure pipe industry is proud to have 60 such customers—utilities that have been buying cast iron pipe for water or gas mains for 100 years or more.

Cast iron pipe has been a rugged, long-lived product from the earliest days. Today's *modernized* cast iron pipe, centrifugally cast, is even stronger, tougher, and more uniform in quality. And, where needed and specified, it is centrifugally lined with cement mortar to assure sustained carrying capacity throughout the long life of the pipe.

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3.

CAST Q IRON

The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

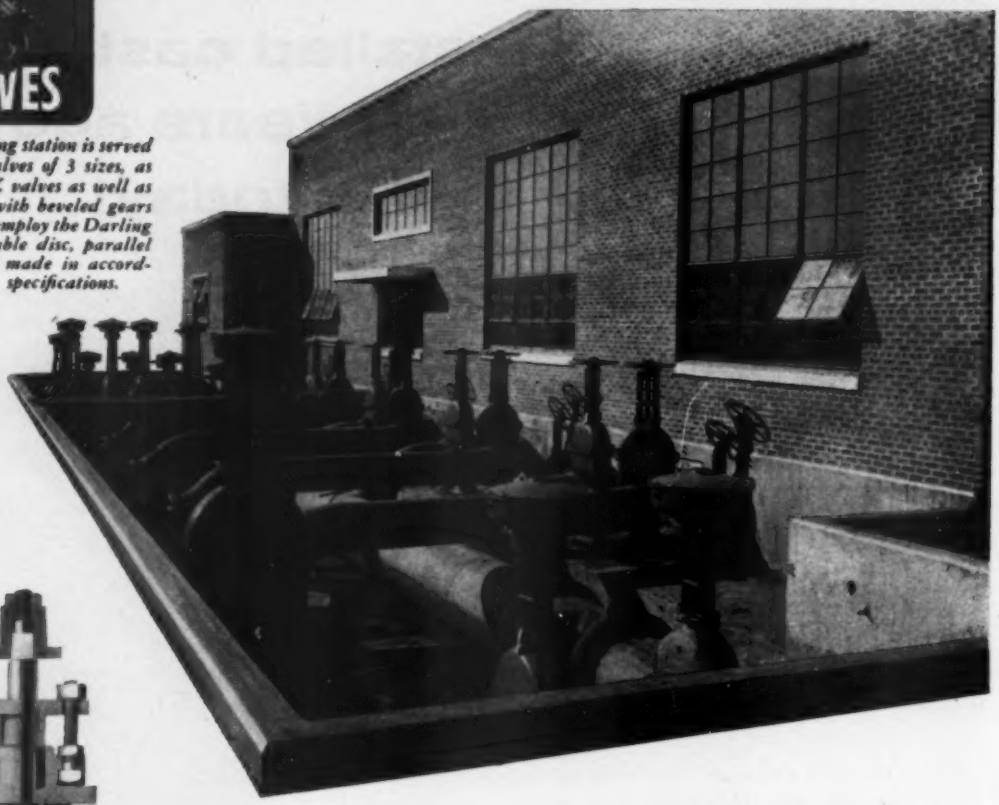
One of several cast iron water distribution mains still functioning in Detroit after a century and more of service.

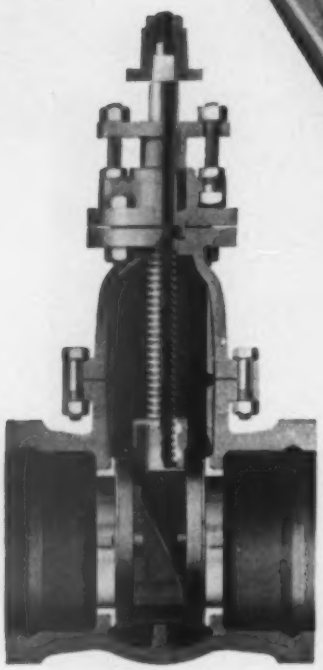
pipe FOR MODERN WATER WORKS OPERATION

DARLING VALVES

FOR PLUS VALUES, JOB-PROVED AGAIN AND AGAIN

This modern pumping station is served by Darling gate valves of 3 sizes, as shown—20" O.S.&Y. valves as well as 30" and 36" sizes with beveled gears and gear cases. All employ the Darling fully revolving, double disc, parallel seat principle, and made in accordance with A.W.W.A. specifications.





Note rugged simplicity of this unique Darling principle—just four sturdy working parts . . . two plain interchangeable no-pocket discs and two husky wedges. Assembly and maintenance is extremely easy and foolproof.

Time and money ahead

THIS new municipal pumping station gains a unique advantage proved in hundreds of similar operations throughout the country. Because these gate valves are Darlings . . . *featuring Darling's fully revolving, double disc, parallel seat principle* . . . the city as well as the water department will be time and money ahead years on end.

If you haven't yet checked into Darling gate valves of this type (shown in cutaway view at left) we'd like to give you *all* the facts on the distinctive features that always add up to . . .

1. Positive, easier closing. 2. Automatic adjustment for valve body distortion. 3. Elimination of disc-to-seat galling. 4. Uniform wear distribution. 5. Greater service life with far less maintenance.

SEND FOR BULLETIN

Darling's latest bulletin is full of helpful information and describes Darling valves of *all* types for every normal or unusual service.

DARLING VALVE & MANUFACTURING CO.

Williamsport 11, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ont.

Constant control of quality

Quality control is a continuous job. It is carried out with modern equipment and painstaking attention to detail in every phase of the production of Nialk chemicals.

for example...

NIALK LIQUID CHLORINE: For many years, communities throughout the country have depended upon NIALK Liquid Chlorine to purify their drinking water. In fact, Niagara Alkali pioneered the commercial production of liquid chlorine and its application in water purification.

Every step in the production of this and all NIALK products is rigidly controlled to give absolute satisfaction in many types of applications.

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- CAUSTIC POTASH
- CARBONATE OF POTASH
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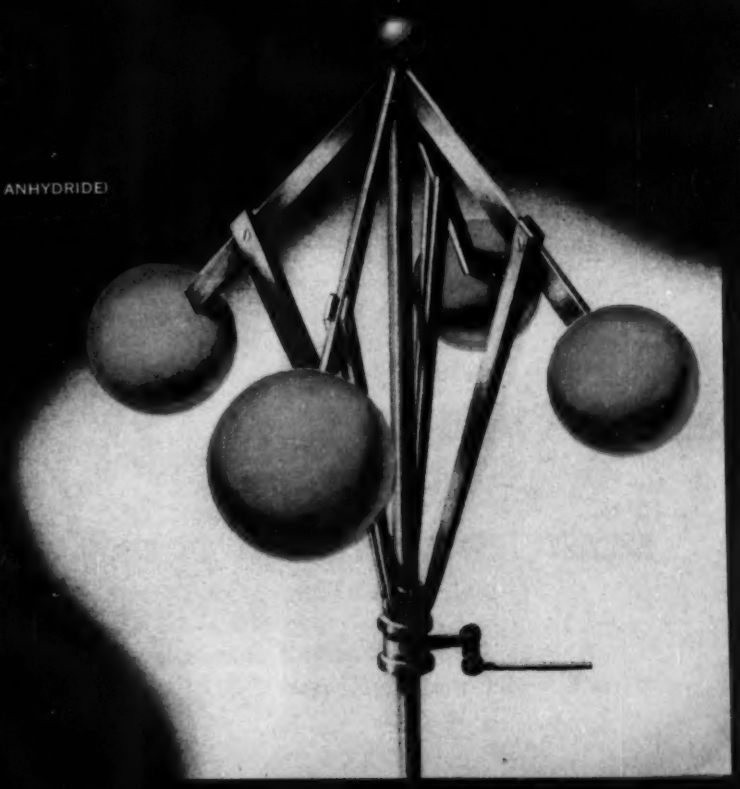
- TRICHLORethylene

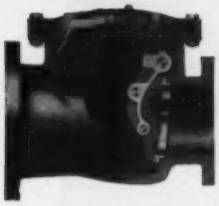
NIAGATHAL (TETRACHLORO PHTHALIC ANHYDRIDE)



12 by 12 List 340
Check Valve
Manchester, N. H.

24 by 24 List 340
Check Valve
Salem, Oregon

Rensselaer



Increasing type with flange ends

CHECK VALVES

Clearway • Quiet Closing • Non-Slam

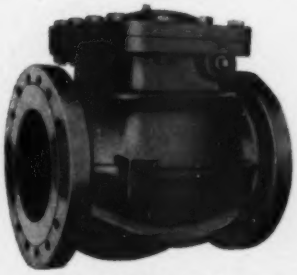
Check valve with hub ends

Heavy slams can cause damages of explosive proportions. Modest slams may throw piping out of alignment and cause serious leakages.

The Rensselaer non-slamming check valve illustrated is low cost permanent insurance against slamming. It is a clearway valve with the gate normally completely out of the line of flow. Head losses are low.

As the velocity at the pump discharge decreases on pump shut down, the lever arm and adjustable spring force the gate toward its seat. At the instant of zero velocity, the gate is on its seat and slamming has been entirely eliminated.

Rensselaer non-slamming check valves are made in sizes up to 30 by 30 inches. Standard check valves up to 60 inches for locations where slamming is not anticipated. High pressure valves up to 400 lbs. W.P. and 24". Ask for Catalog No. E. 108



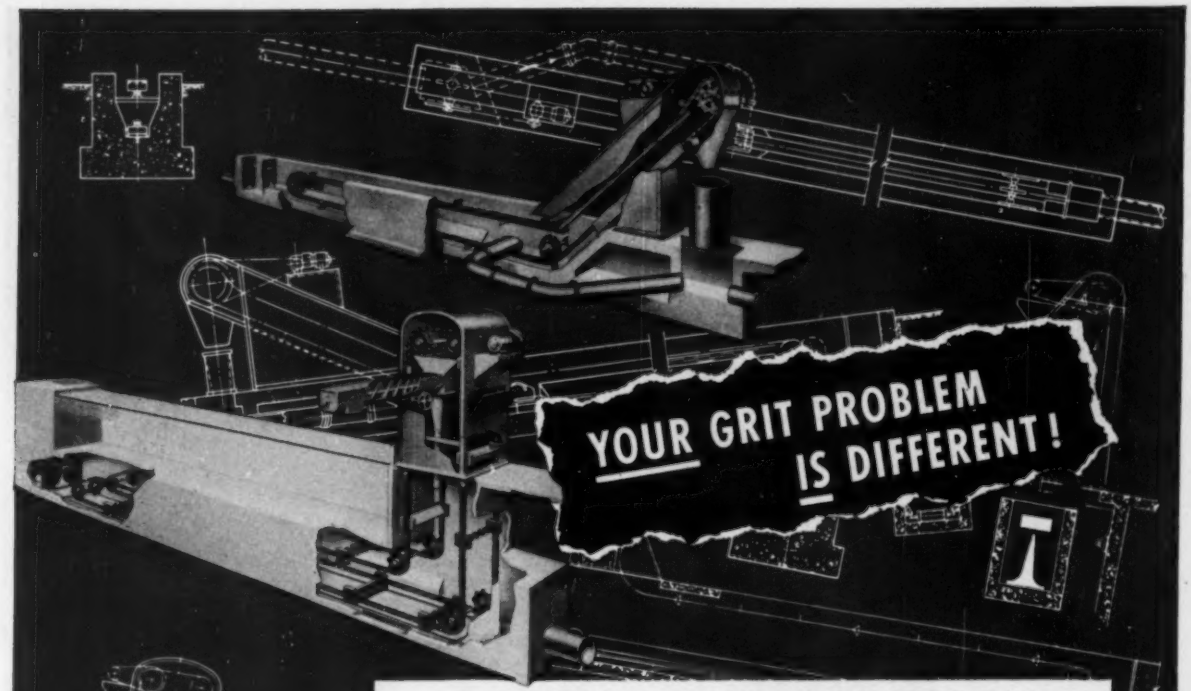
High pressure check valve

Rensselaer VALVE CO. TROY, N. Y.

GATE VALVES • FIRE HYDRANTS • SQUARE BOTTOM VALVES • CHECK VALVES • AIR RELEASE VALVES

SALES REPRESENTATIVES IN PRINCIPAL CITIES

See Rensselaer at Seattle, Booth Nos. 53 and 54



HERE'S YOUR SOLUTION

Every grit problem is *different.* Velocities, head loss, hydraulic characteristics of chambers, capacities, grit size and type, and site conditions—all these factors must be considered in designing efficient grit chambers and collector equipment. There is no one standard answer...no one standard design that can be applied to all problems.

That's why so many engineers rely on Chain Belt Company for the answer to their grit-handling problems. For Chain Belt need not rely on a single standard solution. Each application is carefully studied, and from our background of more than 17 years of experience, we recommend the type and size chamber and equipment you need for most efficient results. In the complete range of sizes and types of Rex® Grit Collectors, there is a basic type that can be best adapted to your individual needs...the one best combination of units that will assure maximum results at lowest over-all cost.

So, whether your plant is large or small, do as so many satisfied users have done, take your problem to Chain Belt.

Take Advantage of These Rex Advantages

Rugged Design...designed and built to withstand the corrosive and abrasive operating conditions ... to handle heaviest loads.

Flexibility of Application...grit channels are designed for each specific application...widest selection of types and equipment to fit any range of channel sizes.

Effective Grit Recirculation... material with excessive organics or improperly separated materials can be recirculated through the channel for resettling. The Rex recirculation feature is rapidly being adopted by others...sure proof that adequate grit conditioning is accomplished by recirculation.

Neat Appearance...head shaft housing completely enclosed. Factory sub-assemblies assure proper field alignment and fit... cut costs and increase equipment life.

For help with your problem, see your nearest Rex Sanitation Engineer or write Chain Belt Company, 4610 West Greenfield Avenue, Milwaukee 1, Wisconsin.

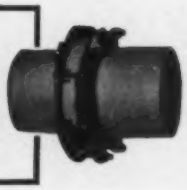
STOP THE CAUSE OF LEAKAGE...*for good!*

By recaulking a leaky bell-and-spigot joint, you are not removing the condition that caused its failure. You still have a rigid joint that might leak again under pipe movement, vibration, other line stresses.

Dresser Bell-Joint Clamps *eliminate this cause* of leakage by sealing the joint with a resilient rubber gasket that absorbs pipe stresses, remains tight for the life of the line.

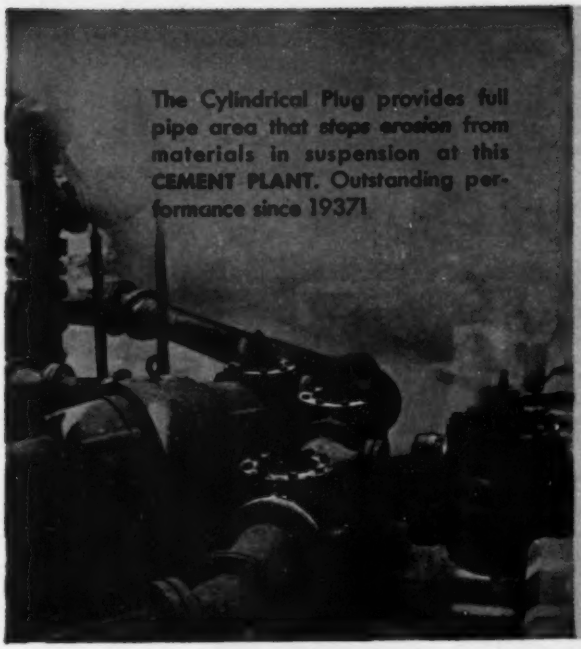
Wherever you have gone to the trouble and expense of uncovering a bell-and-spigot joint—*for any reason*—give it absolute protection against future failure with a Dresser Bell-Joint Clamp, Style 60! Order from your local supplier today, or write us.

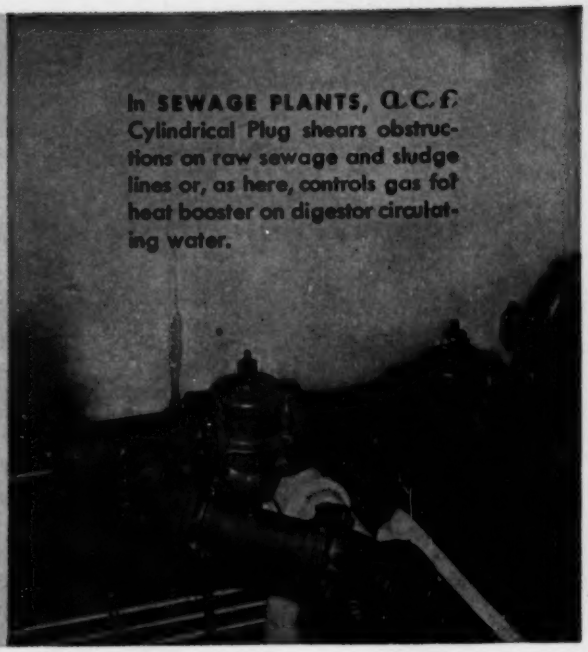
DRESSER®



BELL-JOINT CLAMPS

Dresser Manufacturing Division, 69 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston; 101 S. Airport Blvd., S. San Francisco. Sales Offices also in: New York, Philadelphia, Chicago, Toronto.


The Cylindrical Plug provides full pipe area that stops erosion from materials in suspension at this CEMENT PLANT. Outstanding performance since 1937!


In SEWAGE PLANTS, a.c.f. Cylindrical Plug shears obstructions on raw sewage and sludge lines or, as here, controls gas for heat booster on digestor circulating water.

PROOF OF SUPERIORITY

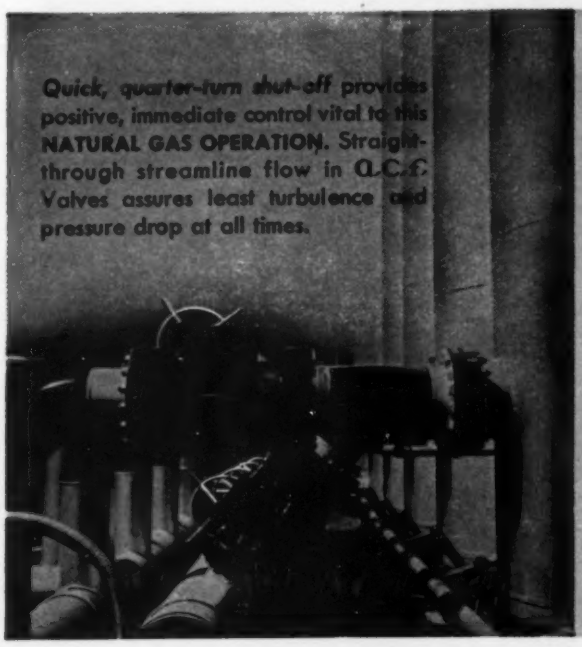
a.c.f.

Representatives in 50 Principal Cities

CYLINDRICAL FULL PIPE AREA

PLUG VALVES

Write for descriptive Catalog 4-WS to American Car and Foundry Company, Valve Division, 1501 E. Ferry Avenue, Detroit 11, Michigan.

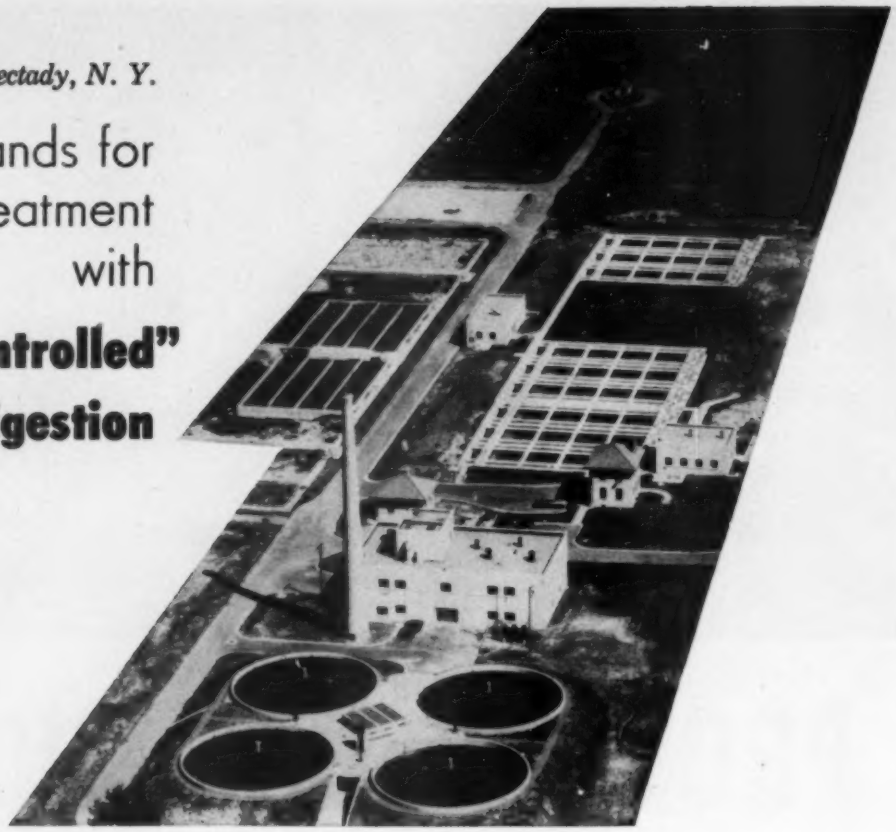

Quick, quarter-turn shut-off provides positive, immediate control vital to this NATURAL GAS OPERATION. Straight-through streamline flow in a.c.f. Valves assures least turbulence and pressure drop at all times.

In PROCESSING PLANTS, a.c.f. Valves provide dependable control of fluids in steady performance in this vital operation for 5 years. Now you get new dependability with TEFLON* HEAD GASKETS.
*A DUPONT PRODUCT

Schenectady, N. Y.

expands for modern treatment with

P. F. T. "Controlled" Digestion



Home of the kitchen "Disposall", Schenectady recently added to its sewage treatment facilities and chose PFT equipment for modern "controlled" digestion!

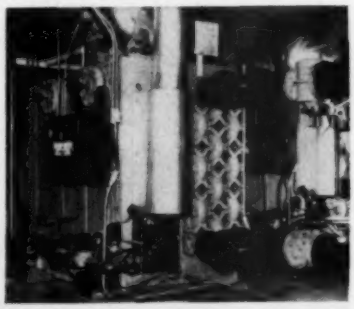
Four 65 foot digestors were added, each equipped with a PFT *Floating Cover* for positive scum submergence and flexible capacity (covers simply rise or lower with additions and withdrawals). With Floating Covers, nuisance from odors and flies is eliminated—explosion hazards are reduced because gas collected under the cover can escape only at the desired point.

Two PFT *Heater and Heat Exchanger* Units—both fired by gas *or* oil—maintain optimum temperatures. Oil firing was used, for example, until sufficient gas was produced by the digestion process to satisfy fuel requirements. Schenectady's two heaters also provide heat for building radiation and pre-heating of sludge.

For automatic, continuous withdrawal of the best digestor liquor, five PFT *Supernatant Selectors* are installed (one fixed, four removable) along with four PFT *Gauge, Sight Glass* and *Sampler* Units. Explosion hazards are further reduced by PFT *Gas Safety Equipment.*

Design and reconstruction of the plant was made under the supervision of Morris Cohn, Schenectady's Commissioner of Public Works. Complete information on all or any part of Schenectady's equipment is yours upon request.

Design of plant by / Havens & Emerson, New York and Cleveland



Two PFT Heater and Heat Exchanger Units

P.F.T.

waste treatment equipment exclusively since 1893

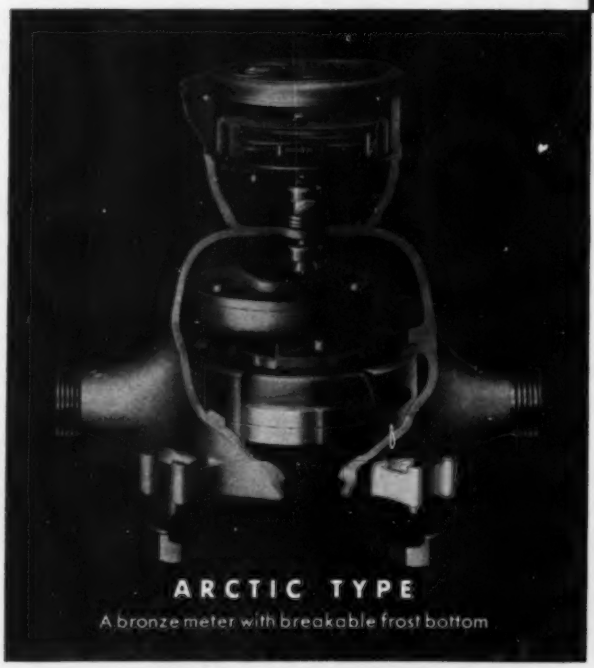
PACIFIC FLUSH TANK CO.
4241 Ravenswood Avenue
Chicago 13, Illinois

NEW YORK • LOS ANGELES • SAN FRANCISCO • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

How you benefit from the *STAINLESS STEEL TRIM* in all Rockwell Disc Meters

SURE, stainless steel costs more than brass. But we use it freely* in Rockwell disc meters for the corrosion resistance and durability it alone provides. We can afford to offer this extra value only because of our huge production volume. We built this volume by building a better product. Now we can pass on the benefits to you in the form of even superior performing meters —meters that last longer because of this construction and are easy and economical to repair.

TROPIC TYPE



ARCTIC TYPE

A bronze meter with breakable frost bottom

All these Vital Parts Are Made of Stainless Steel:

division plates, driving dogs, disc and stuffing box spindles, screws.

Write for bulletin

ROCKWELL MANUFACTURING COMPANY

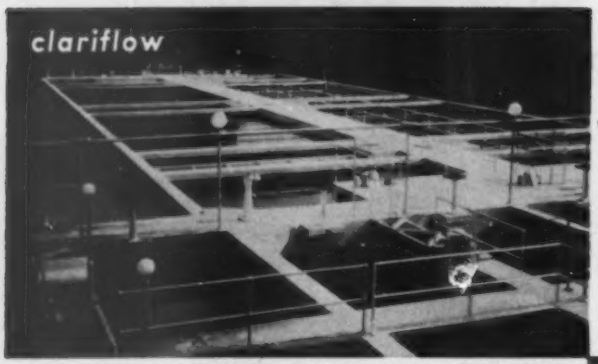
PITTSBURGH 8, PA. Atlanta Boston Chicago Houston Los Angeles New York N. Kansas City Philadelphia Pittsburgh San Francisco Seattle Tulsa

In Canada: Peacock Brothers Limited

The Symbol for Service, Quality and Performance in Water Meters

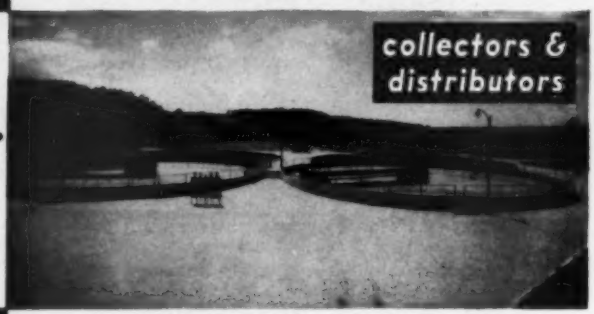
WALKER PROCESS

engineers and manufacturers of equipment for the treatment of WATER . . . SEWAGE INDUSTRIAL WASTE



Two rectangular *Clariflows* 193' x 32' treating 19,600 gpm for turbidity removal at Nashville, Tenn.
The Chester Engrs., Pittsburgh, Pa.—Engrs. Robt. L. Lawrence, Jr. Supt. & Chief Engr., Public Utilities. J. H. Fry, Operating Supt.

The CLARIFLOW is applicable wherever there is a municipal or industrial need for water or waste treatment. It can be used in all operations including combined intimate chemical homogenizing, flocculation and clarification, in rectangular, square or circular basins. The CLARIFLOW gives excellent results in the treatment of municipal and industrial water for—softening—turbidity removal—color removal—algae removal. Industrially it is universally used in—oil separation and emulsion breaking plants—blast furnace flue dust thickening—paper stock reclamation. Write for Bulletin 6W46.

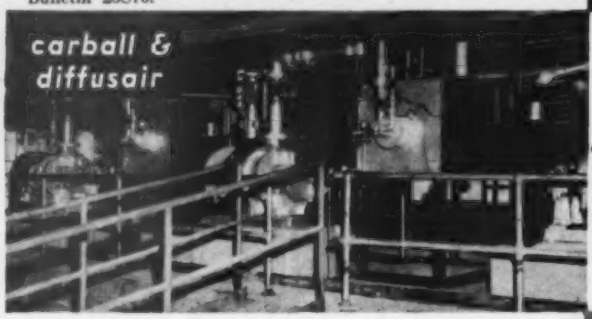


Partial view of four *Tractor Drive* Collectors and three Rotary Distributors installed at North Side Plant of Joplin, Mo.

Chas. A. Haskins, Kansas City, Mo.—Engr. Sid Smith, Supt.

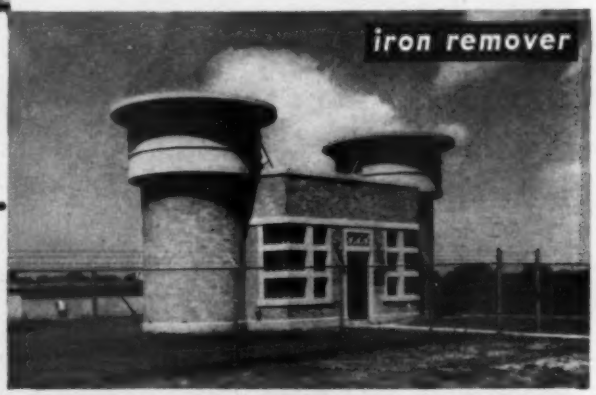
Collectors for square, round or rectangular sedimentation basins are offered for settled sludge or slurry removal. Circular Collector Bulletin 9W65 gives details on Tractor Drive, Suspended and Pier supported units.

Rectangular Collectors are described in Bulletin 8W68. For sewage and industrial waste treatment Rotoseal Distributors with positive Neoprene Seals are universally used. Write for Bulletin 23S70.



Showing two of three oil burning *Carballs* installed at South Pittsburgh Water Co., Pittsburgh, Pa. Each producing 7000# CO_2 per day.
American Water Works Service, Phila., Pa.—Owners and Engrs.

Produces and diffuses CO_2 gas at approximately ¾ cent a pound! Gas is clean and tasteless because of high fuel burning temperature. No need to compress CO_2, as it is under sufficient pressure from burning chamber for direct diffusion below absorbing liquid. Write for Bulletin 7W64.



Unattended *Iron Remover* installation at Aurora, Illinois. Serviced only twice weekly for backwashing. The units completely remove 2 ppm of iron from 1100 gpm of flow.
Walter E. Deuchler Engrg. Co., Aurora, Ill.—Engrs. James E. Barry, Supt.

Iron, manganese and gas removed by backwashable, open contact filter. Only traces of iron and manganese after one pass through contact media. Sectional backwash eliminates media balling and well sand buildups . . . allows backwashing with raw water supply. No chemicals used. Low head loss. Write for Bulletin 1W51.

WALKER PROCESS EQUIPMENT INC.

AURORA, ILLINOIS

"American Water Meters protected our investment by their low maintenance cost"

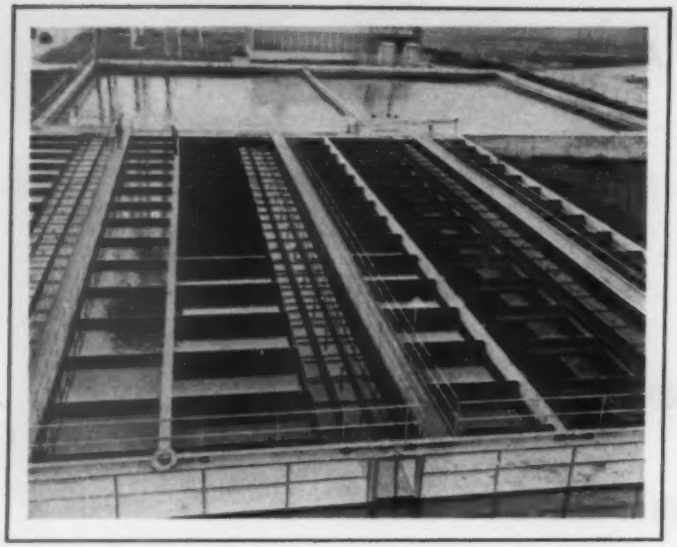
"We buy water meters as a 30-year investment. Naturally we want to protect our investment by keeping our meters in the best possible condition at the lowest possible cost. We've found that the exceptional simplicity of AMERICAN METERS has greatly reduced our maintenance expenses. Fully interchangeable parts are always available for AMERICAN METERS. We've found that true in using AMERICAN METERS for the past thirty years.

" On the basis of past performance, our expected cost per thousand gallons measured will be lowest with AMERICAN METERS. That's why we plan on using them for the next thirty years."

• Write for complete information . . . today.

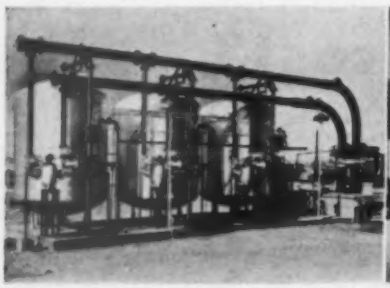
BUFFALO METER CO.

2909 Main Street, Buffalo 14, N. Y.



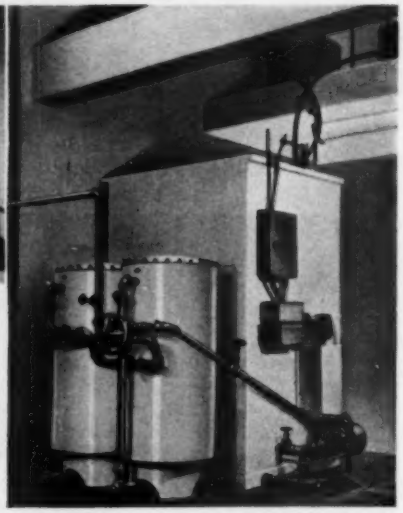
PRECIPITATOR. Coagulation, precipitation and settling in one operation! Minimum space . . . stable effluent. Reduces turbidity, color, taste, odor, hardness, iron, manganese, alkalinity, silica.

WHICH Permutit Process will solve YOUR water problem?



ZEOLITE (Ion Exchange) SOFTENERS remove total hardness. Reduce iron and manganese. Permutit multiport-valve control is fully automatic! Saves operator's time . . . increases efficiency.

FILTERS. Rapid type gravity filters in concrete or steel. Vertical or horizontal pressure filters. Manual or fully automatic multiport-type control for single units or batteries.



PACKAGE WATER CONDITIONING PLANT. Reduces organic matter, turbidity, taste, odor, hardness, iron, manganese, alkalinity. Compact . . . ideal for small municipalities. Flow rates up to 50 gpm.

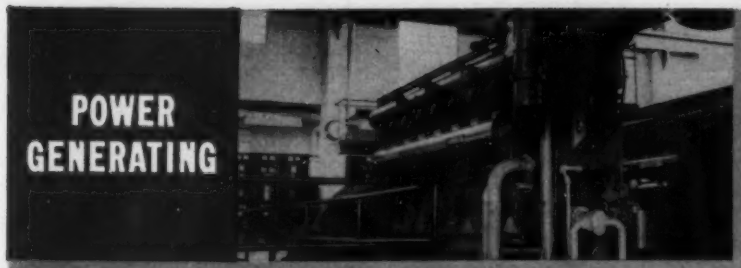
Permutit can help you decide . . .

PERMUTIT will make a free analysis of your city's water supply and make recommendations to you or your consultants. Remember—only Permutit manufactures both ion exchangers and all types of water conditioning equipment.

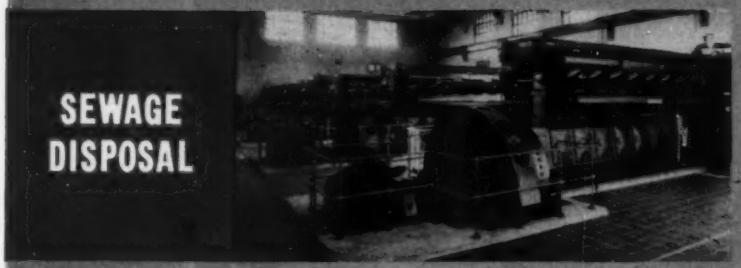
Write today for information on municipal water conditioning equipment. The Permutit Company, Dept. W-5, 330 West 42nd Street, New York 36, N. Y.

Water Conditioning Headquarters for Over 40 Years

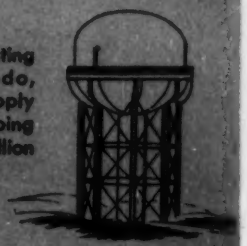
PERMUTIT®



One of four Superior Diesels which provide power for the city of Petosky, Michigan.



Six, Model 80, dual-fuel Superior Engines operating on sewage gas, provide power for all plant equipment when pumping 160 million gallons daily at New York City's Owl's Head Sewage Treatment Plant.



Standby generating plant for Toledo, Ohio water supply system with pumping capacity of 80 million gallons daily.

with SUPERIOR DIESELS

Installations of Superior and Atlas Diesels serve municipal power needs throughout the U.S.A. and in many other parts of the world. These applications are typical of the many ways in which Superior and Atlas Engines are utilized. Records kept by users of these efficient engines point up the economy and dependability of Superior and Atlas Diesels for all kinds of municipal power needs—both continuous and standby.

New bulletins describing the complete line of diesel, dual-fuel, and gas engines are now available. For specific information on the proper type of equipment for any purpose, write Springfield for the name of the Engine Division Representative in your territory.

DIESEL DUAL FUEL GAS — ATLAS Superior DIESEL ENGINES — Superior ENGINES — DISTRIBUTOR OF Lister DIESELS IN U.S.A.

THE NATIONAL SUPPLY COMPANY

ENGINE DIVISION PLANT AND GENERAL OFFICES: SPRINGFIELD, OHIO

SALES AND SERVICE POINTS: Gloucester, Massachusetts • Houston, Texas • Fort Worth, Texas • San Diego, California Oakland, California • Terminal Island, California • Ketchikan, Alaska • Washington, D.C. • Chicago, Illinois • Portland, Oregon • Astoria, Oregon • Casper, Wyoming • Halifax, Nova Scotia • Vancouver, B.C. • Toronto, Ontario • Park Rapids, Minnesota • New York, New York • Seattle, Washington • New Orleans, Louisiana • Pittsburgh, Pennsylvania

A New Valve by SMITH

THE S. MORGAN SMITH COMPANY introduces the

SMITH BALL VALVE! The first showing will be at the American Water Works Association Convention in Seattle, May 23–28, 1954!

The type and design of this Ball Valve have been proven by performance in many installations.

Be sure to see our Representatives at Booths 146-149 at the Convention, or write us direct for data on the Smith Complete Line of Valves.

S. MORGAN SMITH Co.

YORK PENNA U.S.A.

Another good reason

2,500,000-gal. Horton radial-cone bottom elevated water tank built for the South Pittsburgh Water Company for service at Bethel, Penna.

for living in Bethel . . . is the 2,500,000-gallon Horton® elevated water tank that means an increased water supply on hand at all times for domestic needs, industrial service and fire protection. Good water service like this is important in Bethel, Penna.—as it is in every city, town or borough across the nation.

Horton elevated tanks are built in standard capacities to 3,000,000 gallons. Write our nearest office for information, estimates or quotations.

HORTON

WELDED STEEL

STORAGE TANKS

CHICAGO BRIDGE & IRON COMPANY

Plants in Birmingham, Chicago, Salt Lake City, and Greenville, Pa.

Atlanta 3	2181 Healey Bldg.	Los Angeles 17	1855 General Petroleum Bldg.
Birmingham 1	1586 North Fiftieth St.	New York 6	3398—165 Broadway Bldg.
Boston 16	1048-201 Devonshire St.	Philadelphia 3	1644—1700 Walnut Street Bldg.
Chicago 4	2198 McCormick Bldg.	Pittsburgh 19	3260 Alcoa Bldg.
Cleveland 15	2262 Midland Bldg.	Salt Lake City 4	350 West 17th South St.
Detroit 26	1551 Lafayette Bldg.	San Francisco 4	1563—200 Bush St.
Havanna	492 Abreu Bldg.	Seattle 1	1350 Henry Bldg.
Houston 2	2115 C. & I. Life Bldg.	Tulsa 3	1648 Hunt Bldg.

Proud "city fathers" must look to the future, too!

IOWA hydrants and valves are never "orphans"!

No need to worry about the future of your city's water system when you choose *Iowa*. You know you're buying a reliable product from a reliable firm and that there will always be replacement parts, when and as needed. What you may not know, though, is this . . . *Iowa* hydrants are easily and economically serviced—even by new employees without special training.

Below are additional facts to keep in mind when you plan to expand or replace any part of your city water works.

IOWA HYDRANTS

Provide full, truly unrestricted water way.

Open *with* the pressure for faster water delivery.

Close *against* the pressure to eliminate water hammer, provide flushing action.

Assure positive drainage.

Are available for any type of connection.

All working parts removable through top—no digging or special tools required.

Meet all A.W.W.A. specifications.

IOWA GATE VALVES

Double disc, parallel seat.

Positive wedging action for efficient, no-leak closing.

Gates hung loosely from stem nut—no binding.

Rugged, time-proved design means long life, low service costs.

Available with bell, flange, or mechanical joint connections to fit any existing or planned installation.

Meet all A.W.W.A. specifications.

The best insurance policy is the order that specifies IOWA!

IOWA VALVE COMPANY
A Subsidiary of James B. Clow & Sons
201-299 NORTH TALMAN AVENUE
CHICAGO 80, ILLINOIS

Don't let CORROSION put the bite on *your* Sewage Plant this year

PROTECT WITH PITT CHEM!

Don't underestimate sewage corrosion! It's a silent, insidious destroyer, on duty three shifts a day. It takes a tough, heavy film of protective material to give you sure, long-lasting protection against it. Sewage engineers all over the country are specifying *Pitt Chem* Tar Base Coating for the job. *Pitt Chem* is easy to apply, protects metal, masonry and concrete from sewage 7 to 10 years longer than ordinary paint, and its cost fits even the most nominal maintenance budget.

A *Pitt Chem* engineer will be glad to show you how you can protect your investment in sewage plant equipment . . . at a small fraction of the equipment's cost. Why not call for an obligation-free *Pitt Chem* survey today.

W&D 4996

PITT CHEM 101—For Severest Conditions
PITT CHEM 102—Maintenance Coating
PITT CHEM 103—General Purpose Coating
PITT CHEM 104—Potable Water Service
PITT CHEM 105 AQUATAR—A Water Dispersion
PITT CHEM 106 TARMASTIC—Sealing Compound
PITT CHEM 107 PACHKOTE—Specialty Coating
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PITTSBURGH COKE & CHEMICAL CO.

COAL CHEMICALS • AGRICULTURAL CHEMICALS • FINE CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

It has been proven by many years of constant use that the

HERSEY COMPOUND METER

will deliver a more accurate registration of all rates of flow than any single unit or battery of meters. All bronze case from 2" to 6"

A Hersey Creation that has never been equaled

HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO
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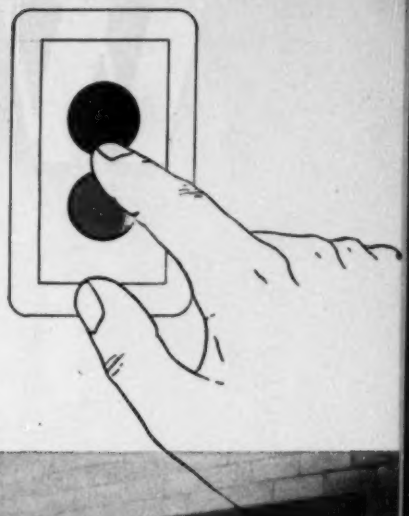
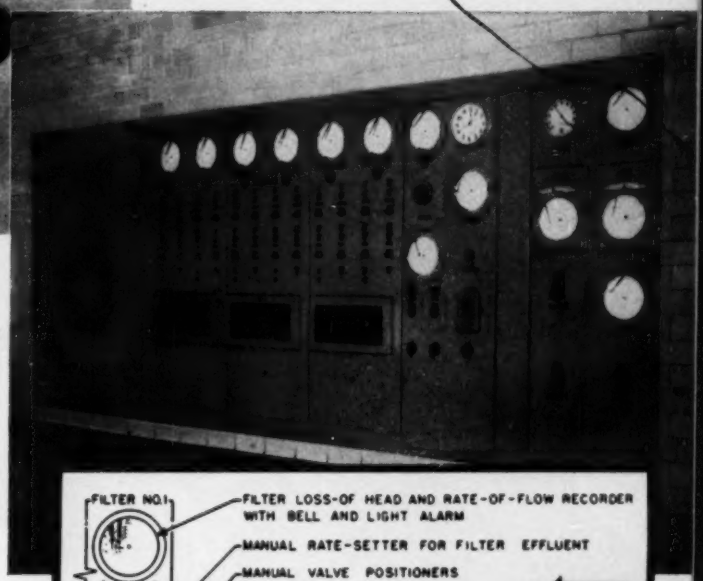
HOW BUILDERS *AUTO-CENTRAL* FILTER CONTROL REDUCES COSTS...



▲ Aldrich Purification Units and Filters at Alexandria plant of American Water Works Service Company.

Central control panel in pump and chemical feed building. From this board, the filter effluent and backwash rates are remotely controlled by means of Builders Auto-Central Control. ▶



The same type of automatic time-sequence operation which has won such wide acceptance for automatic home washing machines now comes to the modern water works. Here is one of the first installations of Builders Auto-Central (automatic-centralized) filter Control, proven by over three years of successful operation at the Alexandria Water Company in Alexandria, Va.

Builders Auto-Central Control has many advantages: It saves time — relieves plant personnel for other duties. It eliminates supervisory headaches. It insures accurate backwash rates, proper washing times, and helps to maintain maximum filter efficiency. It reduces construction costs by eliminating the need for shelter over conventional operating tables.

Here's how Builders Auto-Central Control backwashes a filter: A Builders Loss-of-Head Gauge signals the need for filter backwashing. The pumping station operator (there's only one per shift!) pushes a button which starts the backwash cycle for the proper filter. The Sequence Controller and Pneumatic-Hydraulic Valve Positioners then complete the washing cycle step by step, and return the filter to normal operation TOTALLY UNATTENDED.

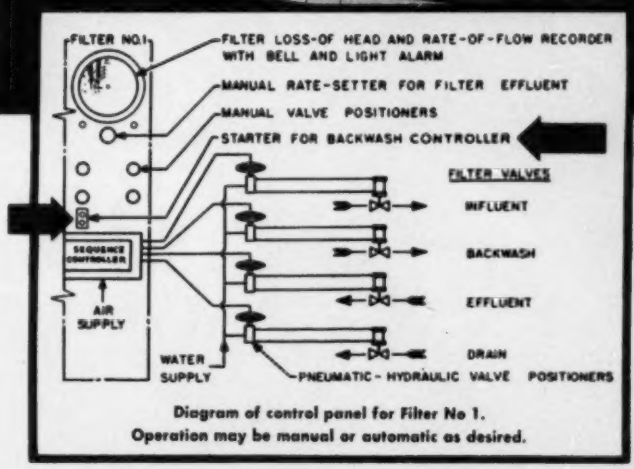


Diagram of control panel for Filter No 1.
Operation may be manual or automatic as desired.

Auto-Central Filter Control is another example of Builders' pioneering in the water works field. For complete details on this or other types of Builders Water Works Equipment, write Builders-Providence, Inc. (Division of B-I-F Industries, Inc.), 350 Harris Ave., Providence 1, R. I.

BUILDERS-PROVIDENCE

DIVISION OF B-I-F INDUSTRIES, INC.

BUILDERS IRON FOUNDRY • PROPORTIONEERS • OMEGA MACHINE CO.

BIF METERS FEEDERS CONTROLS

WATER is vital...

BADGER meters conserve it!

Water saves lives in emergencies... and millions of gallons are required for fire-fighting alone each year. Badger water meters help thousands of communities to conserve water for such needs... measure water precisely for homes and industry ... provide an accurate check on water usage and water waste. And the record of Badger meter performance, known everywhere, has caused thousands of waterworks men to say—"It pays to choose Badger!"

BADGER WATER METERS

BADGER METER MFG. CO., Milwaukee 45, Wisconsin

"Measuring the water of the world"

At Oklahoma City, Oklahoma these modern sewage disposal plants answer the waste problems—

WROUGHT IRON SERVICES

- Jacket cooling water piping
- Low pressure air lines
- Digester sludge piping
- Stop gate frames
- Water piping
- Weir plates

Wrought Iron

answers the corrosion problems

Because successful and economical operation of sewage disposal plants depends heavily on proper material selection, careful consideration was given to every specification written for Oklahoma City's Southside and Northside Plants. Typical of this aim for maximum efficiency and low maintenance was the use of wrought iron pipe and plate in the services listed above.

The Southside Plant, larger of the two and illustrated above, is a two-stage trickling-filter plant; the Northside Plant is an activated-sludge plant. Both plants are new developments in the city's 9-million dollar program to modernize its industrial waste and domestic sewage disposal. Benham Engineering Company, Oklahoma City, were consulting and supervising engineers on the project.

The confidence among engineers and designers in the use of wrought iron pipe and plate for protection against corrosion in sewage disposal services is almost universal. In Salina, Kansas, for example, wrought iron was used in seven vital services. The Independence, Missouri Treatment Plant is safeguarded by wrought iron in four services. Port Huron, Michigan is another installation where wrought iron was selected as a safeguard against corrosion. And at Hyperion Sewage Treatment Plant, Los Angeles, wrought iron was put to work in 51 services.

Our bulletin, *Wrought Iron For Sewage Treatment and Disposal Installations,* discusses corrosion problems in a variety of services, and illustrates how wrought iron is helping to solve maintenance problems to the complete satisfaction of users. Write for your copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Dept.: New York, N.Y.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

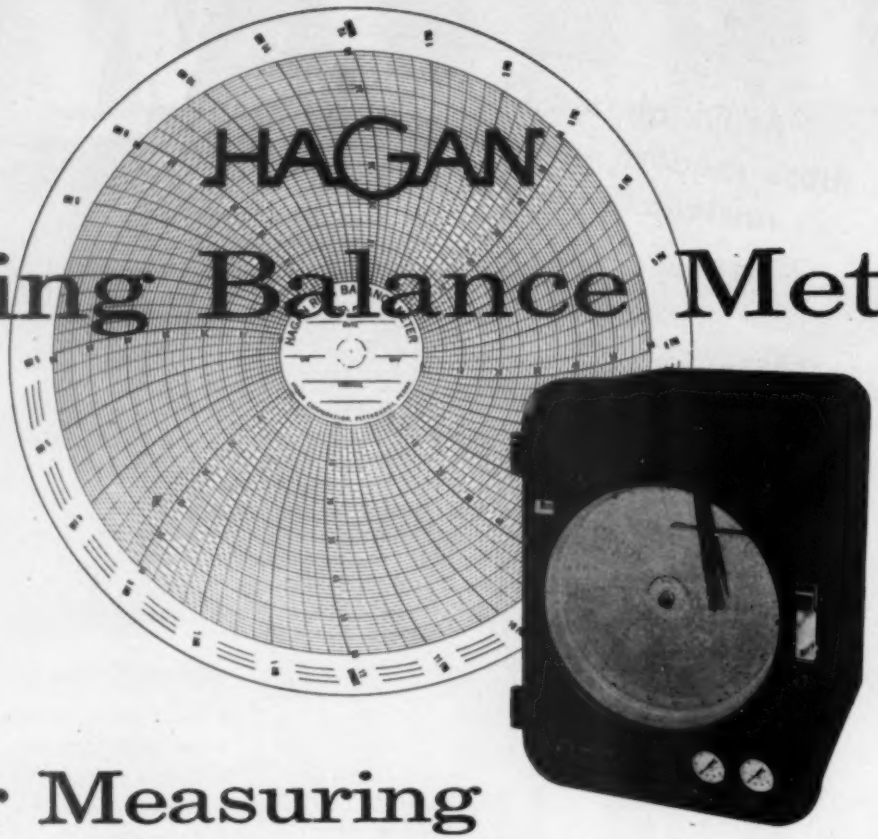
WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

HAGAN

Ring Balance Meters



for Measuring Low Full Scale Differentials

The necessity for measuring flows, with only a low full scale differential available, may result from any of several factors. Type and location of the source of differential, or lines oversize for the flow rate, are encountered most frequently.

The Hagan Ring Balance Meter is particularly adapted for accurate operation at full scale differentials as low as 1″ WC, with any type of primary element—venturi tube, weir, flume, orifice plate or flow nozzle.

For such services, the Hagan Ring Balance Meter has these advantages:

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WATER & SEWAGE WORKS

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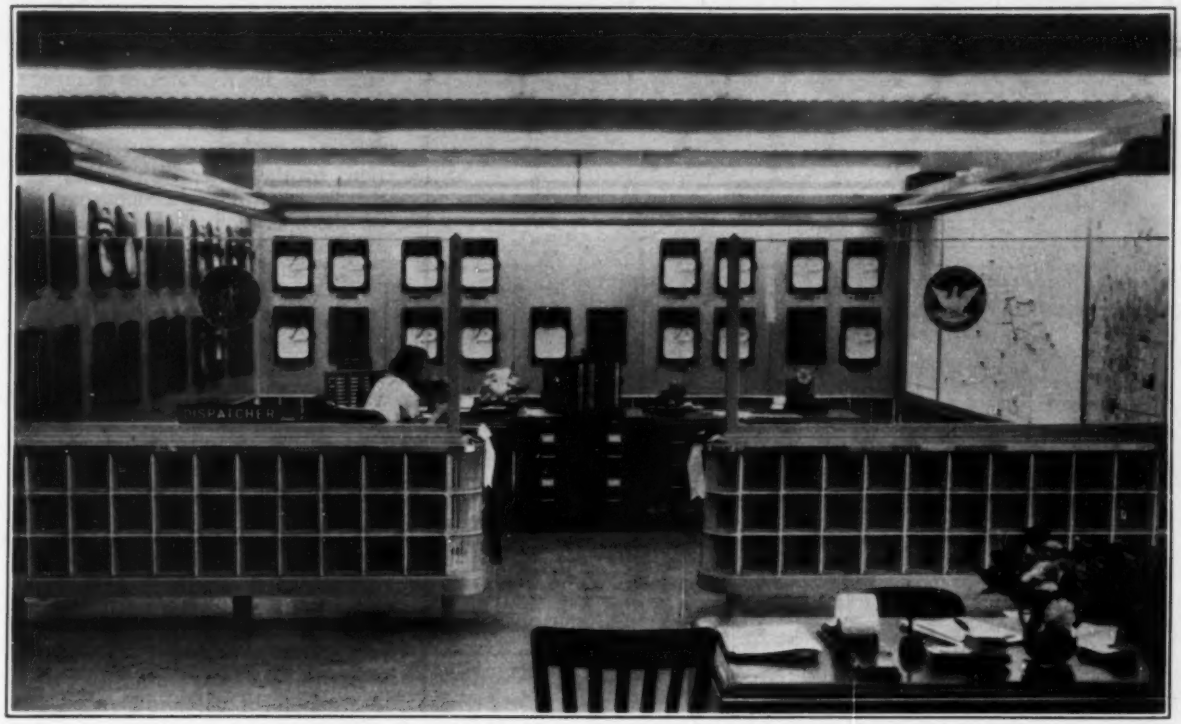


ATLANTA'S new Central Dispatching Station as seen from the lobby—Fig. 1.

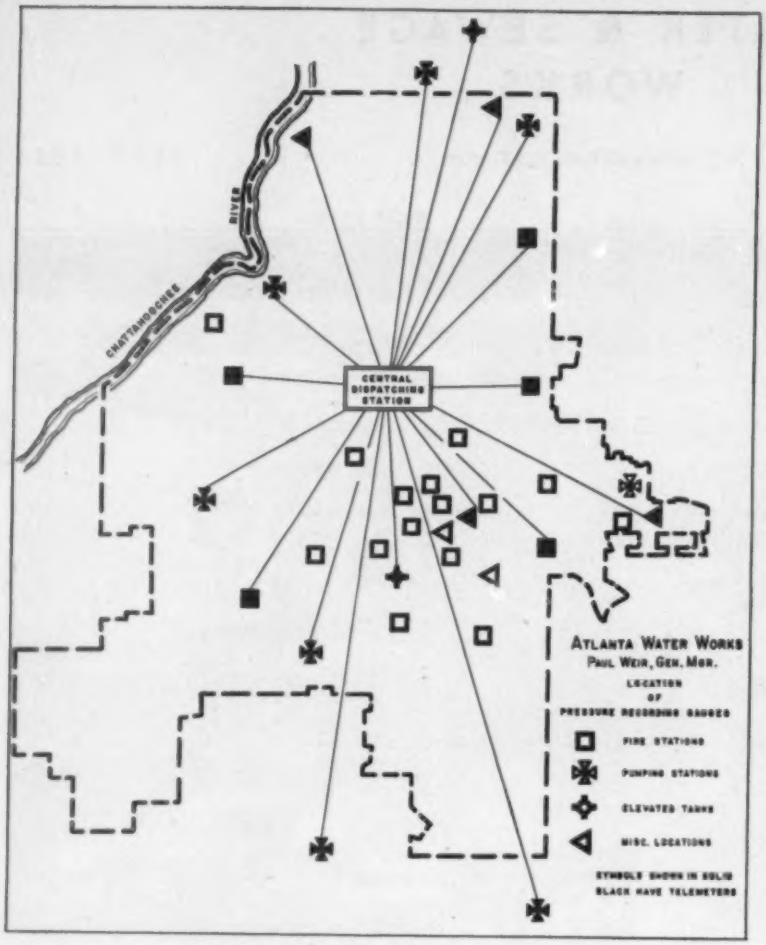
Central Dispatching Station of the Atlanta Water Works

Serves as a focal point from which the operation of the entire system is observed and controlled.

by **PAUL WEIR, *Gen'l Manager, Dept. of Water Works, Atlanta, Georgia***

ATLANTA'S Water Works has grown steadily since its conversion to a municipal utility in 1872. In 1890 the Atlanta Water Department supplied approximately 25,000 people through 3,273 services. On January 1, 1954, 465,000 people were being supplied water through 92,186 services. In addition, water is sold at a metered wholesale rate to four other cities and four counties all of which are located on the periphery of the Atlanta system. The number of consumers has increased at the average rate of 7,400 per year since 1900 and at the rate of 13,000 per year since 1950.

In the past two years Atlanta has annexed 94 square miles of suburban area to the city's original 36 square miles, making a total new corporate area covering 130 square miles. As a result of this large annexation, it has been necessary to extend the Atlanta water system and to provide adequate fire protection. A five-year progressive program was developed to handle this expansion, costing some $1,000,000 annually. This is in addition to a previous program of capital improvements costing $1,000,000 annually also. Under this program, which is in its third year, we have added new water mains to the distribution system at the rate of about 90 miles per year serving approximately 25,000 new citizen-customers annually. The City of Atlanta obtains its water supply from the historic and picturesque Chattahoochee River. The water is pumped from the river to storage reservoirs near the



NERVE CENTER with 21 electronic telemetered arteries to and from pumping stations, elevated tanks and several strategically located pressure recording stations—Fig. 2

RADIO STATION KIC-300 with Dispatcher Evelyn Rickman, our only woman dispatcher, on duty—Fig. 3

geographic center of the city, at which point the water is purified and repumped directly into the 1,200 mile water distribution system.

Need for Pressure Recording Gauges

It is desirable to keep complete records on all phases of water supply operation if satisfactory service and economic operation are to be provided. It is especially important to record the hourly rates of pumpage, water levels in elevated tanks and standpipes and to obtain continuous recordings of the pressure in all sections of the water distribution system, in order to keep a complete check on the operation of the system and also to have strategic data for future design purposes.

Atlanta Water Works recognized this need several years ago and inaugurated a program of installing pressure recording gauges in fire stations throughout the city, in repumping stations and other locations; such as, City Hall, Fire Department Signal Stations, etc. Fire Stations are an excellent place in which to install pressure recording gauges, since they are fairly evenly distributed throughout the city and there are always attendants on duty to notify the Water Department if any unusual drop in water pressure should occur.

At the present time we have twenty 7-day pressure recording gauges in fire stations, fourteen in pumping and repumping stations, three at elevated tanks and standpipes and six other strategic locations Fig. 1). Of this number twenty-one now record through electronic telemeters in the new Central Dispatching Station, as well as at the field locations.

Central Dispatching Station

In 1952 two booster stations were installed to improve service to two small areas near the limits of the system. During a prolonged dry spell of that year two additional temporary booster stations were installed to help supply high areas during peak production hours. The problem of operating three stations and the eight other repumping stations which supply water to adjacent municipalities, counties, military installations and industries indicated the need for a central station where the operation of the entire water distribution system could be observed.

The Central Dispatching Station, while relatively new to the water works field, has proven its worth for many years in the electrical, gas and pipeline utilities. Our first approach to developing a Central Dispatching

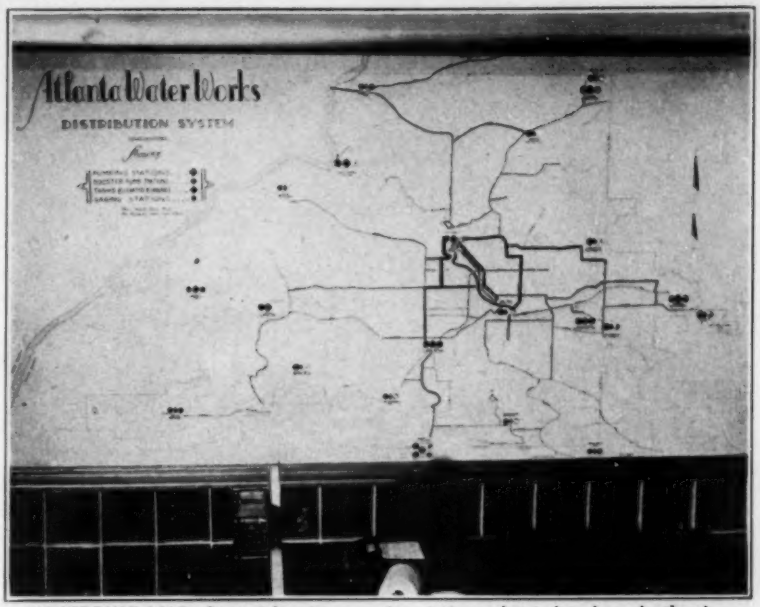
Station for the Atlanta Water Department was to visit other utilities in the city and neighboring area which had used these facilities successfully for some time. It was decided that pressure indicating and recording equipment, Water Department Radio Station KIC-300, fire alarm signal equipment, telephone switchboard and valve location records should be integrated to make up the Central Dispatching Station.

After considerable study, it was decided to locate this Dispatching Station on the third floor of the new Water Works Maintenance and Distribution Shop in the general office area. This Dispatching Station was located in the center of the general office between building columns 20' on centers, thus making a complete enclosure, which would not be objectionable to the other offices and at the same time permitting visibility and flexibility of operation. The lower part of these partitions are glass block. Above it are panel boards of stretched metal on two sides for the gauges, a map board on the third side and the other side is the entrance (Fig 1).

On the panel board opposite the entrance are gauges which record the water pressure at various representative points throughout the system, air and water temperatures, pressure on the raw water mains at the Chattahoochee River Pumping Station and a totalizer showing the rates of pumpage throughout the distribution system.

On the panel board to the left of the entrance (Fig. 3) are the recording pressure gauges, which record the water level in feet in the elevated tanks and standpipes and pressure in pounds per square inches at the various repumping stations. The gauge panels are made of stretched metal over a metal frame and are painted grey. The back of the panels are plywood in sections, which are held in place by friction catches in order that they can be removed with ease to work on the gauges and electric circuits. They are painted to complement the general office surrounding them.

There are openings for 38 gauges in the two panel board sections. There are three maps mounted on the map panel board. These include a polyconic projection map of greater Atlanta and vicinity with index; a lithographed map of the entire water distribution system; a diagrammatic drawing showing the principal trunk mains of the distribution system and location of the telemetering gauges (Fig. 4).



ELECTRONIC MAP of arterial mains, pumping stations, elevated tanks and other important locations of telemetered recording pressure gauges. Colored light buttons reveal system-wide conditions at a glance—Fig. 4

Three Dispatchers Divide 24 Hour Duty

At the center of the room facing the gauges (Fig. 5) are the operators desks on which are the radio consoles, electrically operated in and out service board for radio equipped trucks and cars, telephones and fire alarm signal receiving equipment, which is a punch tape type recorder. Between the two decks are the index and file of plat cards showing valve locations, etc. There is a dispatching operator on duty twenty-four hours a day, seven days a week. Three 8-hour shifts are worked per day. Each operator works a total of 48 hours per week. During the normal work hours the dispatcher watches the pressure recording gauges for low pressure problems, operates the radio and telephone system, checks on fire alarm calls, dispatches work orders to crews and keeps in contact with all radio operated mobile equipment, in order

ANOTHER VIEW of radio-desks, recording pressure gauges, record card files, etc.—Fig. 5

FIRE ALARMS come through on our tape recorder—Fig. 6

that it may be shifted at a moment's notice to meet an emergency. There is usually only one operator on duty per shift but an emergency may require as many as 5 or 6 on duty at one time.

The Atlanta Water Works has operated its own radio station KIC-300 (Fig. 3) since 1949. It becomes a very valuable tool in the operation of our new Central Dispatching Station. Twenty vehicles at present are radio equipped and four remote control stations permit intercommunication between all production plants, the Distribution and Maintenance Shop and City Hall offices. This radio station has paid for itself time and time again since it was placed in operation. For instance, recently we had a 36-inch water main break near our central pumping station, which put the entire city out of water for a limited time. All telephone lines were jammed, prohibiting the completion of calls of official or emergency nature for a period of over an hour. Our mobile radio equipment was called in from the field and used as a source of communication, which permitted the Water Department to repair the main break and restore service with a minimum of down time. The efficient manner in which this major break was handled received complimentary editorial comment from one of Atlanta's largest daily newspapers. More than 100,000 service records and valve locations from plat cards are made available to field crews or others at an instant's notice through our radio equipment.

Pressure Gauge Equipment

A typical water recording gauge 0 to 200 lbs. of pressure is used at all gauging stations (Fig. 7). It has a 12" diameter chart divided into seven days on which an automatic fountain pen records the pressure. All clocks are electrically driven. A pressure record gauge and transmitter is located at each of the points from which the pressure is telemetered to the Central Dispatching Station. The transmitter converts the measured water pressure into a time impulse signal. This signal is transmitted through leased telephone wires electronically to the Central Dispatching Station where a receiver transforms the time impulse signal back to pressure, which is recorded on the pressure gauge charts which are similar to those in the original field unit. At the present time the water pressure is transmitted by this telemetering system from twenty-one stations in the system (Fg. 2). Ten of these points show the water pressure at strategic locations in the distribution system, nine show the pressure in various repumping or booster stations and three show the water level in feet at elevated tanks and standpipes. The panel board design provides ample space for additional gauges as they are needed.

The primary consideration in selecting locations from which the water pressure would be transmitted to the Central Dispatching Station was the sensitivity of the area to pressure changes. The next consideration was to have the gauges spaced so that a drop in pressure in any part of the system would immediately show on one of the gauges in the Central Dispatching Station. Existing gauge locations were used in all but three areas. In these locations sidewalk gauge boxes were used (Fig. 8). These gauge boxes are equipped with electrically-operated thermostatically controlled heating elements to prevent freezing. Each gauge at the Central Dispatching Station is equipped with a recording chart, a sight-reading indicator and two adjustable pressure switches. These switches are connected to a red and green light mounted on the panel board below the gauge and also to a red and green light mounted at the corresponding location on the map on the panel board (Fig. 4). Through hydraulic studies of the distribution system, minimum pressure settings for the gauges have been determined. The pressure switches are set so that the green light burns continuously as long as the pressure is in normal range. The red light comes on if the pressure drops to a predetermined minimum. The pressure gauges, showing the pressure at the repumping stations, are set for maximum and minimum pressures. The red light comes on if the pressure reaches a pre-determined minimum and/or maximum setting. The green light is on only when the pumps are in operation.

Dispatching Operator's Manual

A manual was written covering most phases for operating the Central Dispatching Station. This manual is divided into four sections and a color code is used to designate each section.

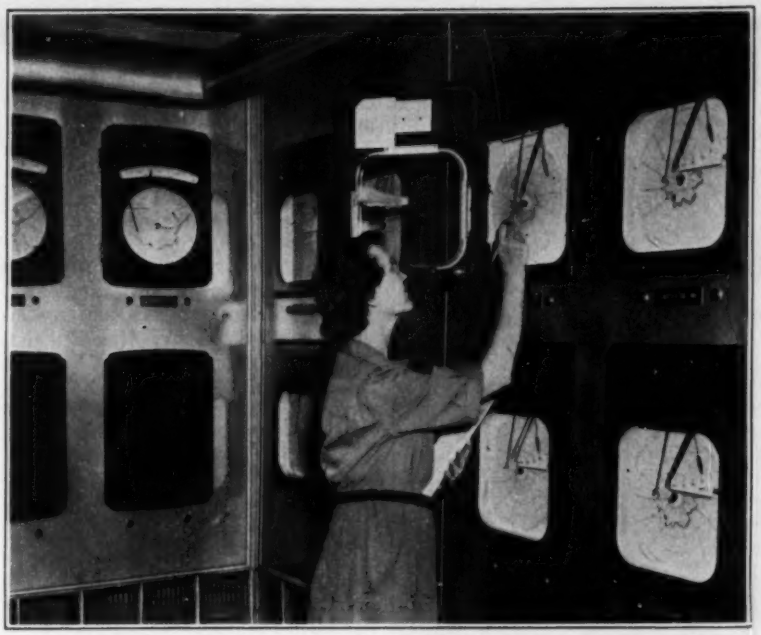
Section one covers special and general instructions for the operator. Under "Special Instructions" is an explanation of the records the operator must keep and how the records must be kept to comply with the Federal Communications Commission regulations. Under general instruction is "What to do in an emergency." This is divided into eight parts; such as, major break on a large trunk main, break on trunk or distribution main, service leak or routine street leak, hydrant broken, meter leak, etc. Under each of these headings is listed, in order of importance, the procedure to follow and the telephone number of all plants or persons the operator is to notify.

The second section is on the fire alarm signals. This includes an explanation of punch tape code, what to do in case of two alarm and general alarm fires and the number and location of all fire alarm boxes.

The third section is devoted to radio equipment. Included is an explanation of the controls and instructions for finding minor troubles in the consoles, instructions for sending and receiving calls, minor adjustments for clear conversations and use of "in and out" service board.

The fourth section deals with pressure gauges. In this section is explained the normal operation of the pressure equipment, including an explanation of the purpose of the red and green lights, an explanation of the pressure setting and instructions for finding minor troubles in the equipment.

This section also includes complete data on each gauge. The location is given, the telephone number, if there is a telephone where the transmitter is installed, the elevation of the gauge, the minimum pressure setting, the normal pressure setting and general instructions on what to do if the pressure is low. If the pressure drops suddenly on any gauge, the instructions inform the dispatcher which other gauges are to be checked for low pressure, where the break might be located and the general area to which a crew should be dispatched to look for the trouble.



RECORDING RECEIVER, showing pressure chart, sight indicator, pressure switch indicators, and operational lights—Fig. 7

Records

Each pressure gauge in the system is numbered. Five series of numbers are used to designate locations and letters are used to indicate if the pressure gauge is connected to the suction or discharge side of a pump and if it is a telemeter recording. All gauges are read and recorded daily at 9:30 A.M., 7:30 P.M. and 4:30 A. M. In the Atlanta system the minimum pressure usually occurs in the morning or during the evening, depending upon the season of the year, and the maximum pressure occurs during the night.

By reading the gauges at these designated times, the minimum and maximum pressure for representative points throughout the system, along with the rate of pumpage and temperature, are recorded for each day on a letter size form. This information, in easily accessible form, is invaluable for hydraulic studies of the system and saves the laborious task of going through hundreds of pressure charts for the data. All the weekly pressure charts are filed in the Engineering Division of the Water Works Shop.

Assistance rendered by W. D. Hudson, assistant engineer of Pitometer Associates, has been invaluable to the Water Department in helping us establish water pressure sampling points and other data throughout the system.

Maintenance of Equipment

A complete maintenance schedule and a full time service mechanic has been responsible for keeping our Dispatching Station equipment, re-pumping stations, tank control equipment, etc., in first class operating condition. We have also established a departmental Instrumentation Committee headed by Mr. Sherman Russell, superintendent of water purification, whose knowledge of this equipment has been of inestimable value to the Department. We also found it advisable to have the service mechanic handle the weekly changing of all charts in the field service and periodically test pressure gauges, controls on re-pumping stations and a multitude of other tasks inherent in the operation of a complex distribution system.

Operation

The new Dispatching Station is an electronic nerve center of the entire water works system. At this central point a graphic picture of the water system operation is recorded on the charts of the twenty-one recording gauges. From this focal point the operation of the system is observed, controlled and the maintenance operations coordinated. Trouble anywhere in the system, of a magnitude that will cause a drop in pressure, is immediately recorded and the attention of the operator attracted by a red light and alarm. When a red light comes on indicating trouble, the operator can, by observing the pressure drop in other areas, determine approximately where the trouble is and dispatch a crew to the area to determine the trouble, isolate and repair it.

Recently a gauge in the North area of the Atlanta Water System showed a sudden drop in pressure at 10:30 P.M. The pressure drop was such that the operator suspected a break in one of the trunk mains to the area. A crew was dispatched to the area and a break in a 16-inch main was located about four miles from the pump station. Through the use of the mobile radio the Dispatcher was informed of the location of the break. The Dispatcher, using plat cards, directed the crew to the valves that had to be closed to isolate the broken section of the main from the system. The total elapsed time between the pressure drop and restoration of normal pressure in this area was less than one hour. Since the Dispatching Station has been in operation, the length of time that service has been interrupted due to pressure drops resulting from broken mains, hydrants, booster pumps failing to work, or from any other causes has been reduced to a minimum.

The new Central Dispatching Station was designed to be, and has proven to be, the nerve center for operation of the Atlanta Water Works Distribution System. Through the use of modern science the operation of the pumping stations, elevated

SIDEWALK gauge boxes are used where the instruments can not be located indoors—Fig. 8a

RECORDING gauge as housed in the sidewalk boxes—Fig. 8b

tanks, standpipes, reservoirs and 1,200 miles of water main can be observed from one focal point. It has eliminated guess work from the operation of the water system. It is another forward step to render better and uninterrupted water service to the citizens of Atlanta.

The author wishes to record his appreciation to Mayor Wm. B. Hartsfield, Alderman James E. Jackson, Chairman of the Water Committee, and the Board of Aldermen, City of Atlanta, for their interest and support in this progressive development program. Grateful appreciation is also expressed to my Water Department executive staff and associates, including Messrs. Roy Ruggles, Superintendent, and C. N. Davis, Assistant Superintendent, Distribution and Maintenance Shop, under whose supervision the new Central Dispatching Station will be operated, and all others who have contributed to the success of this project.

Equipment—Suppliers

Builders—Providence furnished about one half of the pressure gauges and telemetering equipment used in this station, represented locally by W. D. Taulman and Associates.

The Bristol Company furnished about one half of the pressure gauges and telemetering equipment used in this station, represented locally by D. C. Faith.

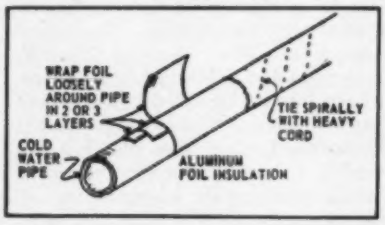
The General Electric Radio Station and equipment, represented locally by J. Bryant, G. E. Electronics Engineer.

Motorola Mobile Radio equipment, represented locally by Kenrow, Inc.

Another Method of Insulating Sweating Pipes

Sweating and dripping water pipes are a nuisance and frequently create damage. The "dew" on the cold water pipes is a condensation of water vapor in the warmer air passing over the cold pipes. In other words, it is a process of dehydration. Some people make the mistake of installing fans to produce forced ventilation. If the outside air is low in humidity the ventilation does some good, perhaps, but how much good is doubtful. If the humidity is high the more air that is passed over the cold pipes the greater the amount of water vapor removed by condensation and the sweating is increased rather than diminished.

The most effective and economical method of preventing pipe sweating is the application of some form of insulation to the pipe. There are a number of ways of applying insulating coverings to pipe. One scheme claimed to be effective and economical is the application of aluminum foil as illustrated in the accompanying sketch which is largely self explanatory. The sheets of aluminum are wrapped around the pipe *loosely*, the objective being to have an air-film



within the wrapping. Note that the sketch calls for two or three layers of foil wrapping and a liberal lapping of the ends of the sheets by about four inches. The aluminum foil is held in place by a simple spiral wrapping with twine, or a plastic tape would serve admirably and produce a neat appearing job.

We cannot vouch for the effectiveness of this method of insulation, but it has been recommended by J. R. Dalzell in his handbook on "Home Building and Repairs." If in itself it proves insufficient insulation for very cold pipes a complete coverage of the aluminum foil (procurable now in all hardware stores and super-markets) with a spiral wrap of one of the 2-inch width plastic tapes should effect complete relief. In case of difficulty in locating the plastic insulating and protective tape, if any reader will let us know we will supply a list of manufacturers and distributors of this tape of many uses.

Los Angeles' Hyperion Plant Expansion Needs Continue

The City Council of Los Angeles has voted an appropriation of $668,000 for additional work on the city's Hyperion outfall sewage-treatment plant. This was for a fifth blower at the plant, it having been found that the four originally specified were insufficient. The cost of the project to date was officially set at $44,679,802.30.

The Councilmen were told by City Engineer Lloyd Aldrich that further expansion of the Hyperion plant will be necessary in the near future. In 1945 the cost of the plant was estimated at $21,000,000.

Pitometer Surveys of Water Systems

How distribution system surveys and flow tests locate leakage waste, water stealing and system defects

by W. D. HUDSON, *Asst. Chief Engr., The Pitometer Associates, Inc. New York, N. Y.*

This paper was presented at the 22nd Annual Water Plant Operators' Conference in Springfield, Ill., and is published in *Water & Sewage Works* with permission.

BEFORE discussing Pitometer surveys, it might be well to explain the word "Pitometer". It is a coined word derived from "Pitot" and "meter." A Pitometer is a reversible Pitot tube. To most water works men, the word Pitometer suggests an engineering service for water distribution systems. The Pitometer instrument combined with The Pitometer Associates' fifty years of engineering experience in the field of water distribution, forms the basis for distribution system surveys.

There are three principal types of Pitometer surveys:

1. Pitometer water waste surveys
2. Pitometer distribution or engineering studies
3. Pitometer trunk main surveys

Water Waste Surveys

The water waste survey is designed to locate underground leakage and waste in a distribution system, and to make a complete accounting of all water that is supplied to the system.

The first step in making a survey is to check any long supply mains for leakage by simultaneous measurements; that is, Pitometers are inserted in each end of the main and the rate of flow is measured simultaneously. If a discrepancy exists between the two measurements, it indicates leakage or loss of water along the supply main. The measurements are repeated, using shorter sections, until the point of leakage or unauthorized use is located.

Next, the pumping equipment is tested for efficiency. These tests very often result in finding inefficient pumping equipment that can be repaired or replaced. Often the saving in fuel cost alone during the first year will pay for the cost of repairing or replacing the faulty equipment, and will enable the water department to provide better service.

Then the master meters are tested for accuracy. This is important as, at times, an inaccurate master meter may be the sole cause of the unaccounted-for water.

After the master meters are tested, a measurement is made of the total water consumption of the city during a twenty-four hour period. Pitometer devices provide continuous recordings of the rate of flow; therefore, the maximum rate of use, the minimum rate of use, or the rate of use at any time during the day can be obtained from this measurement. By comparing the total amount of water used during the twenty-four hour period with the minimum rate of use during the night, it is possible to tell if any large amount of leakage exists in the system.

The next step in the survey is to divide the system into Pitometer districts. These districts are laid out according to conditions existing in the system, and vary as to size in every system. Usually the districts either are residential, commercial or industrial. After the districts have been selected, a Pitometer is inserted in a large trunk main that will supply the district, and all other valves along the boundary of the district are closed. This practice isolates the district from the rest of the system, except for the large main into which the Pitometer has been inserted. A typical distribution system layout is illustrated in Fig. 1.

Pressures are measured before any valves are closed and also after the valves are closed, to be certain that the district has ample feed main capacity. Special attention is given to the possibility of fire breaking out in the district and arrangements made so that, if a fire does occur, additional valves can be opened rapidly—leaving no possibility of inadequate water for fire fighting purposes due to closed valves.

The district measurements show the total consumption of the district for a twenty-four hour period, the rate of flow at any time during the twenty-four hours, as well as the maximum flow and minimum night rate of flow. Taking into account any industrial consumption in the districts, the ratio of the total consumption (water actually used during the twenty-four hours) to the minimum night rate indicates the condition of the system as to leakage or unaccounted-for water. If this ratio exceeds 40 per cent, there is sufficient leakage to justify further investigation.

The district measurements show sections of the city in which leakage exists. If the value of further investigation is indicated by the district measurements, this work is done at night or during the period of minimum flow.

The subdivision or investigation of the night rate is accomplished by inserting a Pitometer on a small (usu-

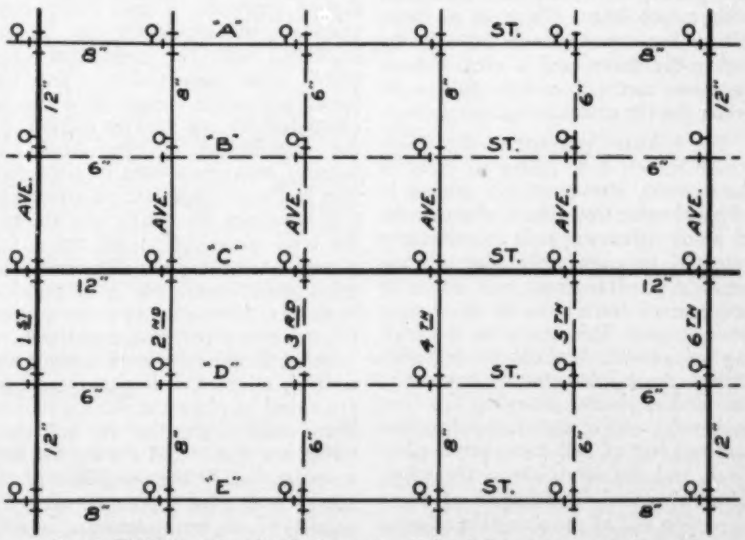


Fig. 1—TYPICAL water distribution system isolated for pressure measurement

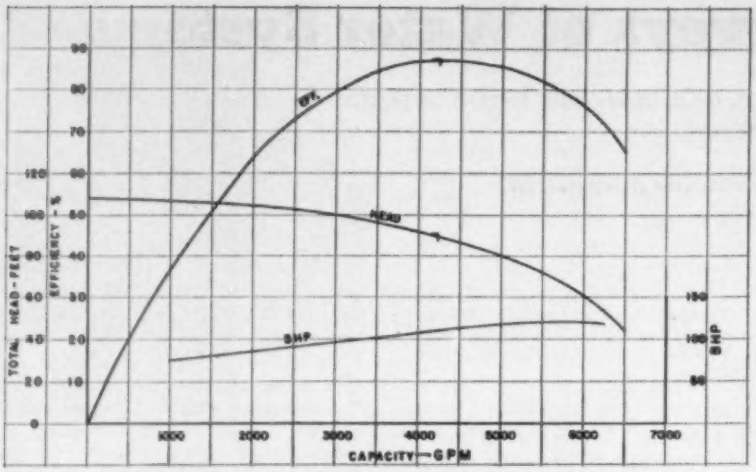


Fig. 2—EXAMPLE of performance curves for centrifugal pumps

ally 6-in.) main, then the valves are closed at each end of the block and a hydrant is opened to see if the water is shut completely off. If the water is not off, the valves are flushed, that is, opened and closed until they hold tightly. Then the feed valve is opened and any flow in the block is recorded on the Pitometer. This procedure is repeated for the adjacent blocks, until the area to be investigated is entirely covered. This results in the measurement of the rate of flow in each block. As this work is done at night, theoretically there should be no flow of water unless there is water escaping through underground leaks or is waste in homes.

Block measurements of the minimum night rate of flow show exactly in which block there is leakage or use of water. The blocks are checked for leakage by using listening devices. Individual services are checked with an aquaphone, and the mains are checked with a geophone. There is no substitute for experience in actually locating the leaks, and a well trained engineer can tell exactly where to break the pavement to reach a leak.

The primary purpose of the water waste survey is to locate all leaks in the system. However, this survey is of equal value to the water department in many other ways. It is absolutely essential to completely shut off the smallest possible areas, and about 80 per cent of the valves in the system are operated. This results in the finding of closed, broken or defective valves. A complete record is kept by the field engineer, recording the time each valve was operated, the direction and number of full turns required to close, and the condition of the valve. Thus a record is obtained of valve operation and of the condition of most of the fire hydrants.

Every valve that is left closed in a system creates two dead ends. On a trunk main, a closed valve may seriously affect the operation of the entire system. On a distribution main, it may be the cause of low pressure, inadequate water for fire protection, or possibly the cause of bad water.

Because it is necessary to obtain tight shut-offs, any connections are discovered that are different from those recorded on the map of the distribution system. The map is thoroughly field-checked and the connections proven. This is important in any system, and are espeically so where the maps were developed on the knowledge handed down and plotted possibly 10 to 50 years after the actual installation was made.

Another and very important by-product of the water waste survey is the use of district measurements to obtain data on the distribution of water consumption in the system for design purposes. These water consumption measurements can be coordinated with the population (obtained from census data), and the actual per capita consumption can be computed for the various sections of the distribution system. Also, the ratio of maximum rates of consumption to the average rate of consumption is known. By taking into account the total consumption for the entire system on the day the individual districts were measured, it is possible to develop all maximum water quantities necessary for design purposes.

In addition to the work already described, all meters larger than 3-in. are tested in place for accuracy. Also many small meters that are not registering are discovered during the leak investigation. At the conclusion of the survey a detailed report showing the results of all measurements is submitted to the Department.

As the result of eliminating underground leakage, finding and opening closed valves, and increasing the efficiency of the pumping equipment, the system often is materially improved and the need for expensive reinforcing mains is eliminated. Leakage is expensive, as plant capacity, main capacity, dollars in power, and chemical costs are wasted.

Distribution Studies

Pitometer distribution studies are made to determine how an existing water system functions and also, if the system is adequate to meet present needs and probable future requirements that will be placed upon it as it is expanded.

As in a water waste survey, the distribution system is divided into districts, and the water consumption is measured in each district for a twenty-four hour period. Then, using census data as a basis, a population study is made for the system as a whole and for each of the Pitometer districts. By coordinating water consumption with population data, the probable future water quantities are established for design purposes.

In making a complete Pitometer analysis of a distribution system, several types of flow tests are made. Most of these tests require both special equipment and trained personnel. Following is a brief discussion of the purpose of each of these tests and a brief description of how some tests are made.

Testing Pumping Equipment

The purpose of testing pumping equipment is to determine the efficiency with which the equipment performs its work. The centrifugal pump is used in most water systems at the present time. Usually these pumps are electrically driven or are powered by a diesel motor. In some larger cities steam turbines are used.

A centrifugal pump is designed to work under rather rigidly fixed conditions and any appreciable variation from these fixed conditions is accompanied by a decreasing efficiency. Too often the only demand made on a centrifugal pump is that it pump water: no attention is paid to the *efficiency* with which it does its work.

A typical centrifugal pump curve is shown in Fig. 2. It will be noted that the greatest efficiency for this particular pump, which is about 87 per cent, is secured when the head is approximately 90 feet and the discharge rate is 4200 gpm; that the efficiency is at least 85 per cent as the

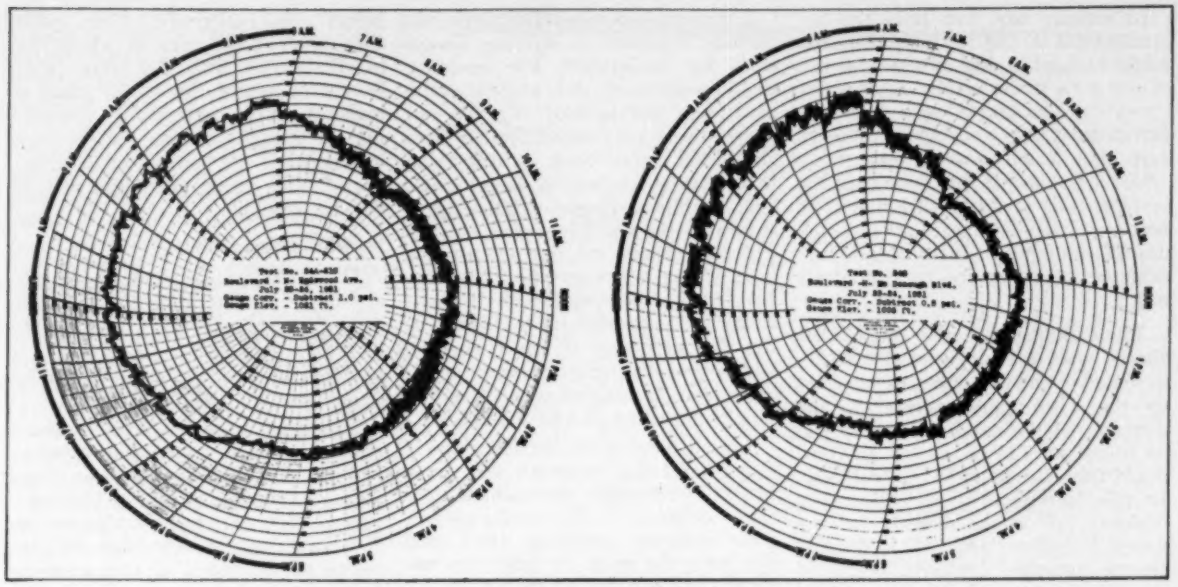


Fig. 3—TYPICAL pressure charts used to determine hydraulic gradient

head varies between 95 feet and 78 feet and the discharge varies from 3600 gpm to 5100 gpm. It will be noted also that if the head drops to 60 feet the discharge will increase to 6000 gpm, but the efficiency will be only 75 per cent; or if the head is increased 10 feet to 105 feet the pump will put out 1750 gpm and be only 58 per cent efficient. If the head is raised an additional 2 psi, the pump will pump no water. Tests made on centrifugal pumps have revealed that, during certain times of the day and under certain conditions, a centrifugal pump may not pump any water into the system, but merely churn the water.

It can readily be seen that each centrifugal pump must be designed for the particular job it is to do, and that in most cases it is false economy to use a pump that does not have the right characteristics for the job. Often an efficiency test on a pump will bring to light conditions that can be corrected with a minimum of expense; when this is done, it will greatly improve the operation of the entire distribution system.

There is an excellent technical paper discussing this subject, prepared by Homer E. Beckwith, District Manager of the Pitometer Associates, Inc. (See "Centrifugal Pumps—Notes on Selection of Pumps and Checking Pump Efficiencies," *Water & Sewage Works*, R & D Edition, page R-73, 1951.)

Flow Gaugings

Flow gaugings are made in the various trunk mains to determine how water circulates through the trunk main system; to determine if the rate of flow in any of the trunk mains is at an excessively high velocity; and to determine if any trunk mains are carrying less water than normally would be expected.

Measurement of the flow of water through the trunk main system is of the utmost importance in the study or analysis of a distribution system. The only feasible way of making this type of test is by using Pitometers. The Pitometer is inserted in the main through a 1-in. corporation cock (as a reversible Pitot tube the Pitometer measure reverse flows in the main). From the Pitometer recorder one can obtain a continuous record of the flow at the gauging point for any period of time that is desired, usually a twenty-four hour period. Thus, at the gauging point, the total amount of water that flows through the main during the twenty-four hours is measured; also measured is the maximum rate of flow and the minimum rate of flow. By making several Pitometer gaugings simultaneously, one can determine exactly how the water circulates through the trunk main system.

Pitometer flow measurements require that special equipment be used by engineers trained to conduct the tests and to interpret the results.

Fire Flow Tests

Fire flow tests are made to determine the amount of water available for fire fighting purposes.

These tests are the one type of distribution flow test that is easy to make and which does not require much equipment. Four dial-type pressure gauges and three hydrant Pitot tubes are all that is needed for most tests. While fire flow tests are rather easy to make, and the computations connected with them are not too difficult, these tests are invaluable to the average water works man in determining whether or not the water distribution system is adequate.

From a fire flow test, the pressure and flow of water available for fire protection at various points in the system can be determined. Also, from the fire flow test, the location of deficiencies can be determined. The National Board of Fire Underwriters' or its affiliates have made fire flow tests in most cities. These tests can be re-run. If there has been no improvement in the system, and if there is a considerable change in the test results, it would be a good indication that something is wrong or that the system has become overloaded at that point. Following is a brief description of the procedure in making a fire flow test.

At the point on the distribution system where the amount of water available for fire protection is to be determined, place a gauge on a fire hydrant. Then place a hydrant Pitot gauge in the nozzle of a second hydrant; or a pressure gauge can be attached to the nozzle of the second hydrant. This pressure gauge must be in the same plane as the nozzle through which the water is drawn. Observe the pressure on the first hydrant, then open the second hydrant and simultaneously read the pressure on the Pitot first hydrant gauge and on the second hydrant gauge.

In making fire flow tests the hydrants used should form a group that might be used in case of a serious fire in the area under study. Also water should be discharged at a rate sufficient to create a drop in pressure such that it will not be measurably affected by normal fluctuations in the system. It is probable that it will be necessary to discharge several hydrants simultaneously to obtain sufficient drop in pressure for an accurate test.

The gallons per minute rate of discharge from each hydrant can be determined from the pressure readings on the Pitot gauge related to the diameter of the nozzle. The flow can be found in a table, or can be computed from the formula: $Q = 27D^2P$. In this formula, "Q" is gallons per minute; "D" is the diameter of the nozzle in inches; and "P" is the discharge pressure (velocity head) in pounds per square inch.

To find the approximate amount of water available at 20 psi residual (the minimum to which a system should be drawn) the computations can be made as follows:

$$\text{GPM Discharge at 20 psi. Residual} = \text{Total of Group of Hydrants Opened} \times \frac{\sqrt{\text{Residual Press.} - 20 \text{ psi.}}}{\sqrt{\text{Residual Press.} - \text{Res. Press.}}}$$

(Hydts. closed) / (Hydts. closed) (Hydts. Open)

As most of the loss is in the main system rather than in the hydrant outlets, the expected discharge can be calculated more accurately from the Williams-Hazen formula:

$$\text{GPM Discharge at 20 psi. Residual} = \text{Total of Group of Hydrants Opened} \times \left\{ \frac{\text{Residual Press.} - 20 \text{ psi.}}{\text{Residual Press.} - \text{Res. Press.}} \right\}^{0.54}$$

(Hydts. closed) / (Hydts. closed) (Hydts. Open)

Fire flow tests often bring to light unusual conditions. If a fire flow test has been made and the results are erroneous, investigate for closed valves. Closed valves frequently are found where fire flow tests indicate something wrong in the distribution system.

Loss of Head Tests

Loss of head tests are made to determine the internal condition of pipes; that is, whether they are tuberculated, or if obstructions exist. The results obtained from a Pitometer loss of head test are expressed as the coefficient of roughness "C" value in the Williams-Hazen Formula.

Running a loss of head test requires Pitometers to obtain the velocity; accurate pressure recording gauges (feet of water) to obtain the head; and an engineer thoroughly trained in this type of work.

Pitometer loss of head tests are extremely important in planning design work for the system. The resulting design work can be only as good as the basic data that is used. No one can guess the internal condition of pipe, and visual inspection is of little value in estimating the roughness coefficient. The Williams-Hazen Tables give values of the coefficient that may be expected, based on the age of the pipe. These tables are quite accurate for the type of water in the area in which the tests were made. However, the characteristics of water vary so widely that the only accurate way to determine the roughness coefficient of pipe is to make a loss of head test.

Loss of head tests also determine if a main-cleaning program will be a benefit by returning the mains to near their original C-130 coefficient. A main cleaning program often will eliminate the need, or delay the necessity for reinforcing the system.

Pressure Recordings

Pressure recordings are made to determine the fluctuations of pressure in the distribution system.

At critical points in a water distribution system, pressure recordings should be considered a necessity. This is one way in which a constant check can be kept on the system. By comparing the pressure gaugings from time to time it can readily be learned if the pressure pattern is changing. If there is a sudden reduction in pressure, and if it continues to stay lower, there is a good possibility that a sizable leak has developed. If the pressure drops gradually, it is probable that the system is becoming overloaded or that the trunk mains are losing their carrying capacity. Permanent seven-day pressure recording gauges should be installed in all pump stations and, usually, in each fire station in the city. As a rule, the fire stations are fairly evenly spaced throughout the city and are a good location in which to install pressure gauges.

If there are complaints regarding a particular part of the system, it is a good policy to run twenty-four-hour pressure gaugings, usually at two points simultaneously. One point should be in the area in which the trouble exists, and the other point should be where the feeder main is made to supply the area. By comparing the gauging charts, the pressure loss between the points can be determined. This procedure might help to find the trouble.

Hydraulic Gradient

Hydraulic gradient measurements are made to determine the pressure drop between various critical points in the system. This type of test is a necessity in order to make an analysis of a water distribution system.

The test is made by placing pressure recording gauges at the critical points and by obtaining the flow at these points by using Pitometers. The pressure gaugings are run simultaneously. It is necessary to determine the elevation of the gauge at each gauging point. See typical charts; Fig. 3. Using the elevation, converting the pressure at the gauging point into feet of water (by multiplying the pressure in psi by 2.31), and adding this value to the elevation, the water level can be determined at each point. These data can then be plotted on suitable graph paper, and the results will show the hydraulic gradient.

Fig. 4 illustrates the hydraulic gradient across a part of a water system. On examination of this chart, it may be noted that the slope is much steeper in the first section of the main. It is obvious that the large loss of head occurs from the pumping station to the first gauging point. The logical step to reinforce this system is to provide additional main capacity from the pumping station to a point in the system that will materially reduce the loss of head in the first section of the hydraulic gradient.

From the data obtained in these tests, a complete analysis is made of the existing system. The weak points and strong points are determined. The tests frequently bring to light such conditions as closed valves, air pockets, badly tuberculated mains, or other deficiencies which can be corrected; thus enabling the system to operate at maximum efficiency without major improvements.

If improvements and reinforcing mains are needed, then information regarding the system obtained in making the tests, combined with the complete data available, will form a sound basis for the design of reinforcements.

Trunk Main Surveys

Trunk main surveys are made to determine how water circulates through the trunk main system, the

mains which carry their share of the water, the mains which are overloaded, the mains which are not operating efficiently, and the internal condition of pipes.

In making a trunk main survey, the trunk main system is divided into test sections. Usually a test section extends between two principal trunk mains. By simultaneously making several Pitometer gaugings, the amount of water entering the section of main to be tested is measured, the take-offs from these trunk mains through principal feeder mains are measured, and the flow out of the test section is measured. Then the adjacent section of trunk main is tested in the same manner. This procedure is repeated until flows through the entire trunk main system have been measured.

By taking into account the pumpage during the days on which tests are made, and by establishing a relationship between the tests by repeating the trunk main gauging common to two test sections, it is possible to simulate the condition of making all tests during a single day. Thus it is determined exactly how the water circulates through the trunk main system.

The trunk main survey is designed principally for large cities having an extensive trunk main system.

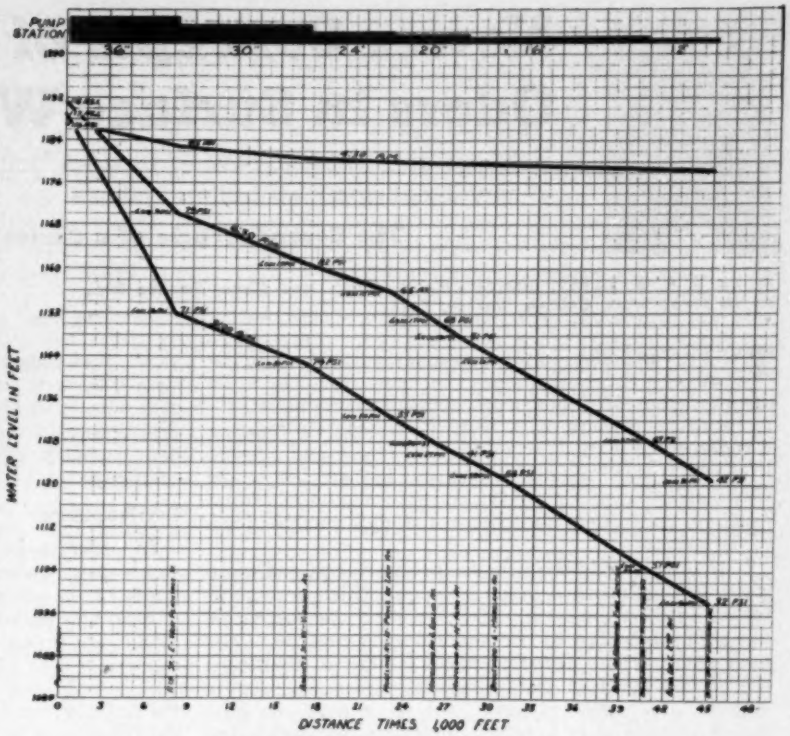


Fig. 4—HYDRAULIC gradient lines of a distribution system

This article very briefly covers the different type of Pitometer surveys and flow tests that are used in analysis of a distribution system. The water departments in large cities seldom maintain sufficient equipment and trained personnel to make a complete study of their distribution systems. It is not economically feasible to do so. It is economical to consult occasionally with an engineering firm about special problems, and to obtain the benefits of experience and technology from men who constantly work on water distribution problems. With present material costs and high taxes, it is essential that improvements involving large expenditures shall be thoroughly engineered.

New Techniques Estimate Reservoir Evaporation

Two new alternate methods of determining reservoir evaporation losses which have been tested at Lake Mead show close agreement and both confirm previous estimates of water losses from the reservoir.

The studies made by engineers of the Geological Survey in cooperation with the Bureau of Reclamation and the Weather Bureau indicate that evaporation from Lake Mead during a recent 12-month period totalled 900,000 acre-feet. This is equivalent to the loss of about seven feet of water off the top surface of the reservoir. Although more water is lost each year by evaporation from this world's largest reservoir than most reservoirs hold when full, the loss is much less than would occur from a shallower reservoir of the same volume.

Further cooperative studies are planned by the Geological Survey, Bureau of Reclamation and the Weather Bureau to obtain additional information concerning the effect of geographical location, altitude, size, shape and depth of reservoir and other factors upon evaporation. A report on Lake Mead water losses is in preparation for publication.

G. A. Fleet Opens Office Representing Manufacturers

As G. A. Fleet Co., White Plains, N.Y., Mr. G. A. Fleet has opened an office as manufacturers' representative. He will handle equipment applicable to the sanitary engineering field, specializing in the following lines: Komline-Sanderson, vacuum filters; Blackburn Smith, sewage ejectors; Process Engineers, equipment; Marlow Pumps, plunger pumps; Morris Machine Works, centrifugal pumps; and Sanitary Specialties, Chemstone slide gates.

Mr. Fleet was previously New York District Manager for American Well Works. He is a registered professional engineer in New York and Pennsylvania, and is a member of A.S.C.E., A.W.W.A., and of New York and New Jersey Sewage and Industrial Wastes Assn.

Large Concrete Pipe Plant In Israel to Supply Vital Water Need

Thirty million dollars' worth of concrete pipe to give Israel vitally-needed water supplies will be produced by a new plant in that country this year, according to a report by Hendrik van Renssalaer, vice president of the Lock Joint Pipe Company of Orange, N.J.

His firm has built the world's largest concrete pipe manufacturing plant in Israel at a cost of $1,600,000, and plans to add two more costing about $250,000. Israel will have the largest water supply system of its kind in the world when the project is completed.

Newer Concepts of Tastes and Odors in Surface Water Supplies

Isolation and identification of noxious actinomycetes in raw-water and distribution systems

The Second Article of a Series*

by **DR. J. K. G. SILVEY**, *Director, Biology Dept., and Chmn. Science Div., North Texas State College, Denton, Texas.*

TASTES and odors in water supplies, particularly in the Southwest, have been shown in many instances to be due to a group of simple plants known as actinomycetes[1]. A historical account with certain explanatory remarks was presented in the November, 1953 *Water and Sewage Works*[2]. It was indicated at that time that another article would appear giving more detailed information regarding isolation, cultivation, and chemical studies on this group of organisms.

The aquatic actinomycetes comprise a varied and large group of organisms. A given technique which proves effective in the cultivation and isolation of one species of this group may fail to rear other species present in the same environment. Consequently, a variety of techniques will be described so that waterworks chemists, bacteriologists, and engineers, may have more than one procedure to employ in isolating organisms responsible for tastes and odors in their water supplies.

It is frequently best to begin any investigation directly in the water plant. We are aware that various chemicals used and types of flocs produced in water clarification drag down all suspended materials including many types of minute plants. Therefore, samples of floc, taken either from primary flocculators or clarifiers, furnish useful source material for the laboratory cultivation of various types of aquatic actinomycetes. Samples collected should be about 100 mls. and should be gathered at two or three hour intervals during the operating day for a period of 48 hours. All catch samples should be placed in one container to produce a composite sample. Since the floc ordinarily contains contaminations of bacteria, yeast, molds, actinomycetes, and algae, direct cultivation of any single group of organisms may pose a difficult problem.

Selective Media

In order to eliminate certain unrelated organisms, it is advisable to prepare an agar that contains varying quantities of copper (Cu) in the form of citrate, acetate or tartrate. We mention these particular copper salts because they are poorly ionized and will not ordinarily be precipitated when the floc is mixed with the nutrient agar. We have found it advantageous to prepare 5 different concentrations of copperized agar. One batch prepared should have 100 ml. of water containing 3 grams of nutrient agar and 0.5 mgms. of copper in the form of one of the copper salts mentioned above. Another batch should contain the same quantities of water and agar, but the copper content should be increased to 1 mg. A third agar medium should contain 1.5 mgms. of copper, a fourth, 2 mgms. of copper, and a fifth, 2.5 mgms. per 100 ml. of the 3% agar broth. Actually, in terms of ppm., the concentrations vary in the 5 media from 5 to 25 ppm. of copper in the form of a poorly ionized copper salt. We are all aware that copper in the concentrations mentioned above is destructive to algae, bacteristatic or bacteriacidal to many forms of aquatic bacteria and fungistatic or fungicidal to the common aquatic molds. On the other hand there is evidence that copper in the concentrations indicated is no more than partially effective against all species of aquatic actinomycetes.

The Procedure

In order to isolate the actinomycetes from the floc, sterile petri dishes should be employed, each receiving 5 mls. of the sample of floc. We have found that the floc is most appropriately added prior to the time the warm liquid agar is poured into the plates. The total amount of copperized agar added to a plate should be approximately 10 ml. Additional amounts will not reduce the growth of the actinomycetes, but will extend the time required for the colonies to be discernable to the naked eye. It is important to be certain that the floc and warm agar medium

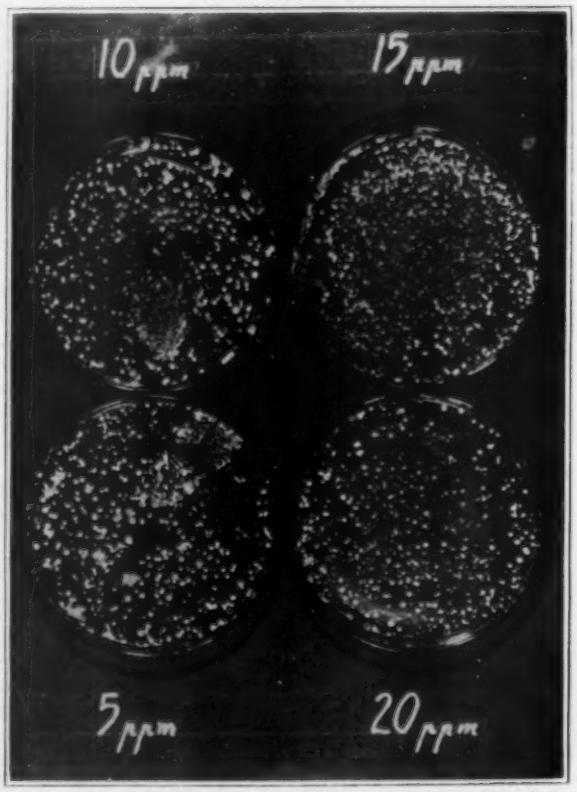


Fig. 1—Typical copperized agar plates with luxurious growth of actinomycetes.
These plates were seeded with laboratory cultures of actinomycentes spores. Note that copper content up to 15 ppm stimulates spore development and mycelial growth.

*The first article of this series was published in *Water & Sewage Works* for November 1953.

are manually agitated until a homogeneous mixture is obtained. After the agar hardens, the covered plates should be inverted, properly labeled, and set aside at room temperature until the agar is completely dry. We are not certain why the aquatic actinomycetes will not grow rapidly on the selective isolation medium. However, once we have cultured them from a water supply, they will usually grow in 24 hours on an agar medium prepared as previously described. It is possible that other organisms in either raw water or floc samples inhibit the growth of actinomycetes or, that more time is required for the spores of the actinomycetes to accommodate themselves to this inhibitory nutrient medium.

A few hours after the plates have been prepared as described, bacteria will begin to grow on the surface and in the interior of the agar. In two or three days a copious growth of molds may be observed. And, after 7 to 10 days, some yeast, additional bacteria, and different molds appear on the surface and within the medium. As dehydration continues, the bacteria, yeast, and molds become slowly dessicated and either die or fall from the surface of the plate. By the time the agar is dry and crisp, similar to a sheet of thin gelatin or cellophane, small lusterless, dry colonies begin to show on the surface of the agar. It is not possible to predict the time required for sufficient dehydration of the agar so that the actinomycete colonies are apparent. A laboratory incubator does not serve an advantageous purpose in this respect, since certain of the strains of aquatic actinomycetes will not grow at temperatures above 25°C (77°F). Most of the common forms will grow at room temperature and it is important to incubate the plates accordingly.

Fig. 2—Typical copperized agar plates innoculated with 5 ml of raw-water.

White colonies are actinomycetes. Dull, opaque colonies are slow-growing forms or yeasts. Note, again, that the best growths are in the copper range of 10 to 15 ppm.

Common aquatic actinomycetes appear to grow best on an agar medium containing from 10 to 15 ppm. of copper in the form of one of the salts mentioned, consequently the highest counts will be found on media within this range—see Figs. 1 and 2. Since a few of the varieties of actinomycetes do not withstand these concentrations of copper, different varieties may be isolated from the agar containing 5 ppm. of copper. In like manner, the colonies discerned on media containing from 20 to 25 ppm. of copper may be different in form, color, or structure. The small colonies on all plates will vary in color from white to gray and green, and some will appear as black varieties. Some of the colonies will be round and smooth, while others will be irregular, conical, possibly with concentric rings (Fig. 4), and still others will appear to have small radiant fissures. Very little odor will be discernable during incubation, due to the lack of water vapor in both the medium and the colonies. The investigator may now count the number of colonies present on each plate and retain the information for later reference. Usually water containing actinomycete by-products will have much higher colony counts than water that is devoid of actinomycete odors. Consequently, if counts are made on the floc during the time when the water is free from musty, woody, hay-like, manurial, or fishy odors, the counts can be kept as a matter of record. One should be advised, however, to do the counts during periods when the temperature of the water is between 48° and 80° F, as is commonly the case when outbreaks of tastes and odors occur in the summer and fall. Suppose actinomycete counts are made on floc samples in May when the average temperature of the water is around 63°F. If a taste and odor problem arises in the raw water at some other period in the year when temperatures are similar, floc counts should tell the operator whether the odor is due to actinomycetes or to some other origin.

Once the small colonies of actinomycetes have been isolated on the dessicated agar (see Figs. 1 and 2), they should be individually transferred to separate nutrient agar slants or in some instances to Emerson's agar or potato starch agar. There is some hesitancy in suggesting the latter two media, since at times the colonies on the dry agar still contain spores of bacteria or fungi that have not succumbed in the copperized agar, consequently transfers from the small colonies may carry over spores of organisms that are not actinomycetes. Our routine is to make transfers to nutrient agar for 48 hours and then transfer to other agar slants at the end of the second 48 hours, and continue for a period of two weeks. This procedure generally results in the isolation of a pure strain. From 24 to 48 hours after the pure strain transfers have been made, the growth of the actinomycetes on the agar medium is sufficient for the investigator to smell the top of the cotton plug and note the type and intensity of odor produced by this organism.

The Effect of Chlorine

It is interesting to note that chlorine may be used in place of copper to inhibit excess growth of non-actinomycete organisms on agar plates. If it is desirable on the part of investigators to use chlorine in lieu of copper, the following procedure is suggested: The samples of floc should be divided into five aliquots. The samples should be treated so that the first aliquot receives 5 ppm. available chlorine, the second, 10; the third, 15; the fourth, 20, and the fifth, 25 ppm. After the chlorine has been in contact with the floc samples for 30 minutes, transfers may be made directly to petri dishes and regular double strength nutrient agar employed as a culture medium. It is somewhat surprising to note that copper and

Fig. 3—Actinomycetes enmeshed in floc or adhering to host aquatic growths as viewed under high powered microscope.

chlorine are about equally selective as to the types of organisms inhibited and the varieties that grow on the plates.

Other Inhibitors

We have attempted to use other inhibitors that are bacteristatic or bacteriacidal as well as fungistatic and fungicidal compounds. Chlorbutanol may be used in concentrations up to 60 ppm. and effectively remove most of the contaminating organisms from water or floc samples, without apparently preventing the growth of most of the aquatic actinomycetes on the culture medium. Phenol in concentrations of 6 ppm. does not appear to be injurious to these aquatic forms although we have not regularly employed it since our results with copper and chlorine appeared to be most satisfactory.

Examination of Purified Water

In properly operated water plants, samples of tap water, water from under the filters, and clear well samples are run continuously by some member of the staff. Not only are presumptive and confirmative tests done for the coliform group, but plate counts are routinely run in order to get an idea of the total number of bacteria present in the finished water. Since most of the bacteria and fungi have been removed by flocculation, clarification, filtration, and chlorination, it is not necessary to add copper or chlorine to these water samples. Routine analyses used for colony counts may be performed as usual and a portion of the agar plates may be retained at room temperature for a period of time sufficient to permit them to thoroughly dehydrate. By this system, the number of spores of actinomycetes may be determined for these samples. I would venture a guess that most tap water in America, if properly sampled would show a contamination of aquatic actinomycetes in clear wells and distribution systems, particularly in spring, summer and fall.

Actinomycetes Multiply in Distribution Systems

We have sampled 40 distribution systems and have not experienced negative results in any of them that carry purified water from surface sources. It is true that terrestrial actinomycetes of soil origin may be found in tap water on occasions when new pipe is being put into service. Those forms are so resistant to chlorine and caustic that concentrations used for pipe sterilization are not effective in eradicating those forms, however we are inclined to think that the terrestrial actinomycetes do not propagate in the water distribution system. On the other hand, aquatic actinomycetes do propagate in distribution systems and as long as corrosion, irregularly treated water and organic slimes occur on the interior of pipes in the distribution system, actinomycetes will continue to propagate. Contents of chlorine sufficient to sterilize the pipes would be much too high to be carried in any distribution system since the final water would be useless to the consumer. We believe that the information obtained from actinomycete counts on floc and finished water would be useful records to aid in the operation of any water purification plant interested in producing odor- and taste-free water.

Ample records of these counts over periods of two or more years should reveal to the purification engineer whether the actinomycetes are causing the tastes and odors. One should be apprised of the fact that actinomycete spores may increase without odors and tastes increasing since we know that certain terrestrial forms may from time to time enter the water supply. The main point of concern would be to note if the actinomycete counts did increase when the odor increased. If they do not, it is almost certain that the tastes and odors are produced from sources other than those under consideration. It is probably important in any distribution system to take spore counts on tap water samples from various parts of the city during the summertime. We know of several instances where the purification plant was putting out a water with a threshold odor of 2, while the consumer was receiving water with a threshold odor of 10—and even 16 in a few instances. This odor increase in the distribution system was not due to any immediate fault of the purification process. It was currently being caused by the organisms growing upon nutrient substances in the pipes of the distribution system. Procedure followed in handling this problem will be the subject of a subsequent article in this series.

Keeping a Watch on Source of Actinomycetes

If complete records are to be kept in the operational sections of a water plant, it is of importance that the filtration engineer and his staff be thoroughly familiar with the biological conditions of the raw water. Wherever practical, samples of raw water should be procured from the reservoir or stream at particular points designated as sample stations. If ample aid is available, several sampling stations should be established in shallow water and two or more stations in deep water. Samples should be procured at regular intervals during the winter time and more frequently during the spring, summer, and fall. It is a practice of many water plants to do routine plankton

counts in which the number and kind of algae are recorded for the various stations and depths in the water supply. In many instances the plankton counts are significant since they show the number and kinds of organisms available in a floating form in a water supply. It is our contention that more available information than mere count of plankton should be obtained for permanent records. Concentrated samples of lake water containing algae and other types of animal and plant life should be homogenized in either a glass homogenizer or a small mechanical stirrer. The purpose of this practice is to bring about a cellular destruction of these organisms thereby liberating the contents of the cell into the fluid mixture. The homogenous fluid should then be treated either with copper or chlorine as previously described and plated out in order to obtain an aquatic actinomycete spore count. If careful records are maintained showing the type and number of organisms, the actinomycete count and the threshold odor number, it will not be long before graphs and curves can be constructed which will enable a filtration engineer to look at a count of a particular algal form and knowing its past history in relation to actinomycete count and odor number, he can predict what odors he may anticipate in the raw water and be ready to cope with the situation when it develops. At best, one might state that plankton counts are in many instances significant, but without threshold odor numbers and actinomycete counts, the picture is incomplete and the situation at the water plant is not completely under control.

The personnel that investigates the raw water supply should be forever cognizant of attached algae, underwater vegetation, floating vegetation, and emergent plants. Attached algae, either around the periphery of the lake or even in deeper areas of clear water serve as ideal hosts for the actinomycetes—(see Fig. 3). These forms in small groups or clumps may furnish more nutrient for actinomycetes than the entire population of floating algae so frequently counted and classified by the water plant personnel. Examinations of the attached algae and attached vegetation frequently give highly desirable information. Samples may be homogenized or they may be placed in a blender and reduced to a thick viscous fluid. By sampling this material the source of actinomycete populations and products may be readily discovered. Since so far as we know, actinomycetes do not nurture themselves in water devoid of other types of plant and animal life, serving as hosts, regular sampling of raw water for actinomycete colonies will probably not give basic information of economic value. Soil actinomycetes will frequently be cultured instead of aquatic forms. Since it is not at present possible for a laboratory worker to determine which type of actinomycete he is rearing, it is doubtless profitable to secure all actinomycetes directly from microscopic plants or animals, or from attached forms. These will be true aquatic actinomycetes that are responsible for many types of tastes and odors.

At the present time, we have not gone sufficiently far in our investigation of the taxonomy and morphology of aquatic actinomycetes to offer our services for complete identification. We would be pleased indeed to receive samples of any actinomycetes isolated from various sources of water supply and would give the investigators as much information as we have available on the occurrence of the genera in North America and the types of problems these organisms have produced in other areas. We have hopes that in due time we may be more capable of offering our services for complete identification and the proper evaluation of corollary data relative to a local water problem.

References

(1) Silvey, J. K. G., Russell, James C., Redden, David R., McCormick, William C., "Actinomycetes and Common Tastes and Odors," Jour. Water Works Ass'n., Vol 42, No. 11, Nov. 1950.

(2) Silvey, J. K. G., "Newer Concepts of Tastes and Odors in Surface Water Supplies," Water and Sewage Works, Vol. 100, No. 11, Nov. 1953.—(The first of a series of articles currently appearing in this magazine.)

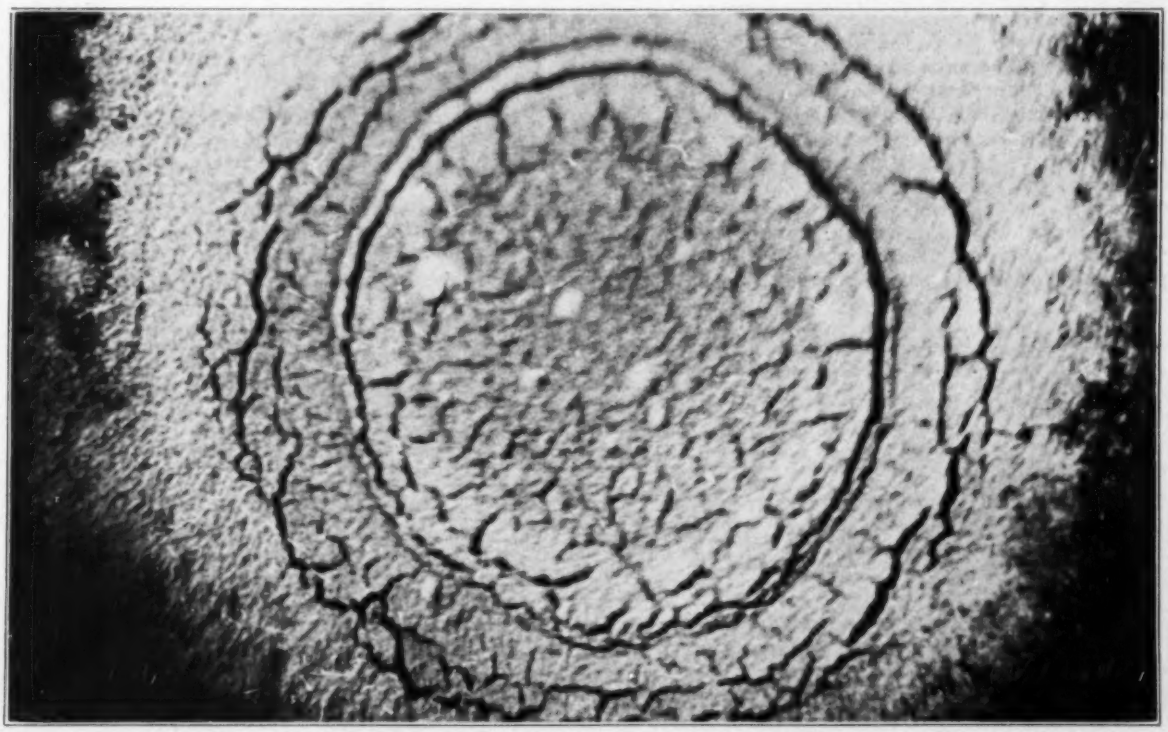


Fig. 4—Actinomycetes colony on dehydrated agar media. Note the characteristic concentric ring formation and radial checking.

Water Utility Office Operations

Standardized procedures and forms essential to good management

by JAMES M. SYMONS, School of Civil Eng., Class of '54, Cornell University, Ithaca, N.Y.

WATER is our cheapest commodity; ten tons for a dollar, twenty-six flushes of a toilet for a nickel, or 385 glasses for one cent. Few persons realize just how little water costs, and fewer still realize how inexpensive is the delivery of water. The consumer who turns on a faucet expects to get clear, safe water, whenever he wants it and in whatever quantity he desires.

What does this most important service in the community cost? Four dollars for the 1000 cu. ft., and 33 cents per 100 cu. ft. for the next 4000 cu. ft. delivered through a ⅝-in. meter. These figures make the service sound inexpensive, but when one realizes all the routine involved in providing that water at the consumer's tap, the cost seems even less.

The many problems of supplying water became apparent to the author when he worked in the office of the Westchester Joint Water Works No. 1 in Mamaroneck, N. Y., in the summer of 1953. The office work alone involved in getting water to a new consumer is interesting, complex, and detailed. When the details were tabulated as part of a study of office operations, it became evident that procedures could be organized into six categories. It is the purpose of this article to present these detailed procedures for the persons who may be interested in water works management.

About the Author

We are pleased to present the first solo article by a "third generation water works man". No stranger to many of our readers, "Jimmy" is becoming known at water and sewage works meetings. His first contribution to *Water & Sewage Works* was the front cover picture in November 1948.

Grandson of Martin Symons, late Chief Engineer of the water works in Danville, Ill., and son of "Doc" Symons, Consultant and Technical Feature Writer, of Larchmont, N.Y., "Jimmy" has has garnered a few honors in his own right. He is a member of Tau Beta Pi, national honorary Engineering fraternity and of Chi Epsilon, national honorary Civil Engineering fraternity, and has been Vice President of the Cornell Student Chapter of ASCE.

Next year, "Jimmy" plans to attend M.I.T. for graduate study in Sanitary Engineering.

The Utility

The Westchester Joint Water Works No. 1 is unusual in this respect: It is owned by three political entities: The Town of Harrison, the Town of Mamaroneck, and the Village of Mamaroneck, all located in Westchester County, just outside of New York City. Besides supplying these communities, it also serves portions of New Rochelle and the City of Rye. The utility obtains its water from a small impounding reservoir on a small stream. It serves 40,000 customers through 7000 meters, and owns a 6.0 mgd rapid sand filter plant, and a 7.5 mgd pumping station which pumps New York City water (with chlorination only) when the stream flow is insufficient.

Operation of the utility is under the management of a Board representing the three communities and is under the direction of George H. Straub, Supt., and Stanley A. Longhurst, Asst. Supt. The office is located in Mamaroneck, N.Y., and is managed by a chief clerk who supervises this staff: Senior stenographer, stock clerk, billing machine operator, accounting machine operator, cashier, billing clerk (who assigns work to the service men), junior clerk and telephone operator. This office staff plus the plant operators and maintenance crew handle the job of water supply in these suburban communities.

The problems of office management in reference to new services are classified in six stages: (1) Preliminary to service connection, (2) tapping, (3) meter purchasing, (4) meter installation, (5) billing, and (6) month-end clerical work. The first step begins when a local developer, who

METER			SET		REMOVED		PREMISES		CONTRACT NO.
NUMBER	SIZE	MAKE	DATE	READING	DATE	READING			BOOK PAGE
							SECTION	BLOCK	LOT OR PARCEL

DATE	OWNER	ADDRESS	TENANT

	10___		READINGS		CONSUMPTION	CHARGES		ARREARS	AMOUNT DUE	DATE PAID	AMOUNT DUE	CASH RECEIVED	OTHER CREDITS	BALANCE
	FROM	TO	PRESENT	PREVIOUS		METERED WATER	MISC.							

Fig. 1—LEDGER account sheet (14 x 11 inches)
The reverse side of the sheet is the same

SERVICE calls for many activities

Replacing a meter | Meter reading | Installing 1½-in. service line

owns land in one of the districts, decides to put in a new street and build houses.

Preliminary to Service Connection

The builder must bring plans for the development to the water office for review by the Superintendent, who determines the size of main needed to meet the expected demand according to the sizes of the houses to be built and the number of water-using appliances to be installed. The Superintendent must also determine from the expected demand whether or not the development can be supplied from existing mains; if not, plans must be made to reinforce the network of mains. Once the main size has been decided, the Supterintendent prepares an estimate of the cost of the work by listing the materials needed with prices obtained from the stock book. The completed estimate is given to the Senior Stenographer, who checks and types it in duplicate, one copy being sent to the Board (governing body) of the District in which the development is to be constructed, the other copy being sent to the developer (contractor).

The District Board (political subdivision) reviews the estimate and plans, taking into account the zoning laws, general development of streets, etc., to determine if the project will fit into the present area planning. If satisfactory, the development plan is approved. The developer must then deposit with the Water Utility, the estimated cost of the work. The District Board sends approval of the work to the Water Office. At the next regular meeting of the Water

Date wanted .....

TAPPER'S REPORT of SERVICE CONNECTION

Section ..... Tap No. .....
Block ..... Acct. .....
Lots ..... District .....
Premises located at .....
in the ..... Owned by .....
Plumber ..... Builder .....
To be used for supply to .....
Size of tap ..... " Size service ..... " Size of main ..... " Depth .....
Date made ..... 195 Tapper .....

—DIAGRAM—

Entered on Map by .....
Mat'ls entered by .....
Service Chg. $ .....
Date Paid .....

WESTCHESTER JOINT WATER WORKS NO. 1
REPORT OF MATERIAL USED

Cat. No.	Quantity	Size	
			CORPORATIONS
5202		"	Corporation Stops—Copper Service
5240		"	" " Outlet increased to 2" I. P. size
5304		"	" Quarter Bend—Copper Service
5302		"	" Eighth " — " "
			CURB STOPS
5046		"	Stop & Drain—Copper to Copper
5041		"	" " " — " " Female iron pipe
5091		"	" " " —Lead flange to iron pipe
5096		"	" " " — " " lead flange
			COUPLINGS
5600		"	Copper to Female iron pipe
5603		"	" " Male " "
5640		"	Lead flange to female iron pipe
5644		"	" " " male iron pipe
5642		"	" " " lead flange
5610		"	Copper to copper (two part)
5615		"	" " " (three part)
			ELBOWS
5626		"	Copper to copper
5628		"	" " Male iron pipe
5630		"	" " Female iron pipe
			TEES
5620		"	Male iron pipe to copper to copper
5622		"	Copper X copper X copper
5624		"	Copper X copper X male iron pipe
			OTHER MATERIALS
	ft.	"	Copper pipe
		x	Pipe saddle
			Curb box complete
			Top section only
			Bottom only
		"	Curb Rods
		"	Valves
			Valve box—complete
			Top section only
			Bottom section only

LABOR

SERVICE MAN ..... hrs.
HELPER ..... hrs.

DATE ..... 195 .....
Service Man

Fig. 2—TAPPER'S report of service connection and report of material used (8½ x 11 inches)
Front and back of form.

ORIGINAL This copy to be sent to stock Record when goods have been delivered to Department ordering.

REQUISITION

From _____ Dept. _____ Date _____

Wanted _____ For { Order No. _____ / Replacement Equipment

QUANTITY	DESCRIPTION

☞ Requisitions for articles not carried must be approved by Works Mgr. before purchase is made.

Approved _____ Signed _____

FOREMAN WILL NOT USE THIS SPACE

Purchase Order No. _____

Ordered From _____

No. 501—Goldsmith Bros., Stationers, 77 Nassau St., N. Y. 8

Fig. 3—REQUISITION form for meters (5⅞ x 9 inches)

Utility Board the approval of the District Board is reviewed, and if okayed, a resolution is passed to proceed with the work. The estimate is then assigned an authorized number and filed. A copy of the estimate is given to the Chief Clerk for comparison with the actual cost of the work.

The work of laying the main begins with the contractor digging the trench for the main. When the Water Office is notified that the trench is ready, the maintenance foreman, after obtaining the necessary street opening permit, assigns men to the job; they pick up the needed materials from the pipe yard, proceed to the location and lay the main. When the job is completed, one of the maintenance crew inspects, tests, and sterilizes the main with HTH, a high test hypochlorite.

Before the trench is backfilled by the contractor, the maintenance foreman measures the line, lists all of the appurtenances installed, and makes out his report on the material actually used. This report goes to the Stock Clerk and then to the Chief Clerk, who calculates the actual cost. The actual cost is then compared to the estimate (which was on deposit) and any difference settled with the contractor. A sketch of the main is then made for inclusion in the authorization file and the new street is drawn on the master map of the streets in the District.

Tapping

Two sections of the "Rules and Regulations" cover the matter of service lines. One states, "At the time of signing for water service, the owner or his agent shall pay in advance, the charge for taps and service connections which are as follows: ¾-in.—$35; 1-in.—$45; 1½-in.—$75; and 2-in.—$130." The other regulation says, "Contractors, builders and others will be required to obtain a written permit from the Superintendent of the Water Works before using water for building and construction purposes or for temporary use of any kind. The Superintendent may require from such contractors, builders or other temporary users, a deposit to cover the estimated charge for the water to be used."

The various steps and office details involved in the tapping category include these, in the order of performance.

1. Builder must file, in duplicate, an application for the tap and pay for it at the charges set forth above.

2. Cashier accepts payment, posts it in the cash register and makes a folder for the account file.

3. Builder deposits with the Cashier the amount of the estimated charge for water to be used during building.

4. Location card and charge memo (indicating amount paid) are made out by Cashier.

5. The location of the property is verified on the assessment map and the new account number is entered thereon.

6. A ledger sheet for the account (Fig. 1), prepared by the Junior Clerk, and the charge memo goes to the Accounting Machine Operator, who enters the charges and credits on the ledger sheet and files it in the ledger sheet "buggy."

7. Cashier makes out a tapper's report (Fig. 2) showing house location, size of tap, size of main, and account number. This report then goes to the Billing Clerk.

8. On receipt of a report from the builder or contractor that a trench to the house is ready, the Billing Clerk assigns a tapping crew to the job.

9. After the service is installed the tapper's report is completed to show a sketch of the curb box location and all materials used.

10. The completed tapper's report goes to the Stock Clerk, who notes the materials used and then gives it to the Junior Clerk, who files it in the account file.

PURCHASE ORDER

Westchester Joint Water Works No. 1 **No. 2979 B**

129 Halstead Avenue
Mamaroneck, N. Y.

To _____ _____ 195__

You are hereby authorized to supply:

UNIT PRICE EXTENSION

This order subject to the following conditions:

1. Invoice must be rendered on Claim form accompanying this order.
2. Claim must show trade and cash discounts.
3. Shipment must be prepaid. Transportation tax will not be allowed as this is a tax exempt, Municipally Owned Corporation.
4. Submit affidavit for waiver of Federal Excise Tax.
5. Claim must show our Purchase Order Number.

Westchester Joint Water Works No. 1

_____

Fig. 4—PURCHASE order form (8½ x 13 inches)

Meter Purchase Procedure

The Water Works Utility keeps a number of meters of all sizes in stock and purchases them in lots of 24 or more. For the purposes of this discussion the purchase procedure will be outlined for a single meter.

1. The purchase is originated by Meter Repair Foreman and approved by the Superintendent, in his capacity as Purchasing Agent, by making out a meter requisition (Fig. 3).

2. In accordance with the requisition, the Stock Clerk prepares a purchase order (Fig. 4), in triplicate. One copy (yellow) goes to a permanent file, one (pink) goes to the Meter Repair Foreman, who will receive the meters. The original is signed by the Superintendent and mailed, with a claim form (Fig. 5), to a meter manufacturer.

3. When the meter is received, the Cashier makes out a meter card, on which the serial number is entered. On this card will be entered the complete history of the meter in service, its installations, removals from service, repairs, etc.

4. When the meter is received, the pink copy of the purchase order is checked against the invoice by the Meter Repair Foreman and both are returned to the Stock Clerk.

5. When the manufacturer's notarized claim is received by the Senior Stenographer, it too goes to the Stock Clerk for checking (against invoice and pink copy of the purchase) and O.K.

6. The okayed claim, invoice, and pink copy of purchase order next go to the Chief Clerk, who enters the amount and company owed in the Voucher Register.

7. The Cashier draws a check for the amount in question and enters this amount in the Cash Book.

8. The okayed claim and check goes to the Superintendent and Auditor for approval. At the next meeting of the Water Works Board the Chairman and Treasurer of the Board sign the check and it is mailed to the manufacturer.

9. The claim, invoice, and pink copy of the purchase order are filed. When the cancelled check is returned, it, too, is filed.

Thus, the records of meter or any other purchases become a part of the permanent files of the Utility.

Meter Installation

When the builder has used up his building water allotment, a meter must be set. A meter installation card is issued in duplicate, and the standard installation fee is charged to him. These standard fees are:

Size of Meter	Amount
⅝-in.	$ 6.00
¾-in.	7.00
1-in.	8.00
1½-in.	10.00
2-in.	12.00

When the meter is to be set, the Billing Clerk is notified, the work assigned, the meter picked up from stock, and set. The man setting the meter fills in the necessary information on the meter installation card, the the original being returned to the Cashier, who files it in a permanent file and creates a meter reading record (Fig. 6), noting the meter serial number and the date set. This record is placed in a meter reading book in its proper relation to the neighboring houses.

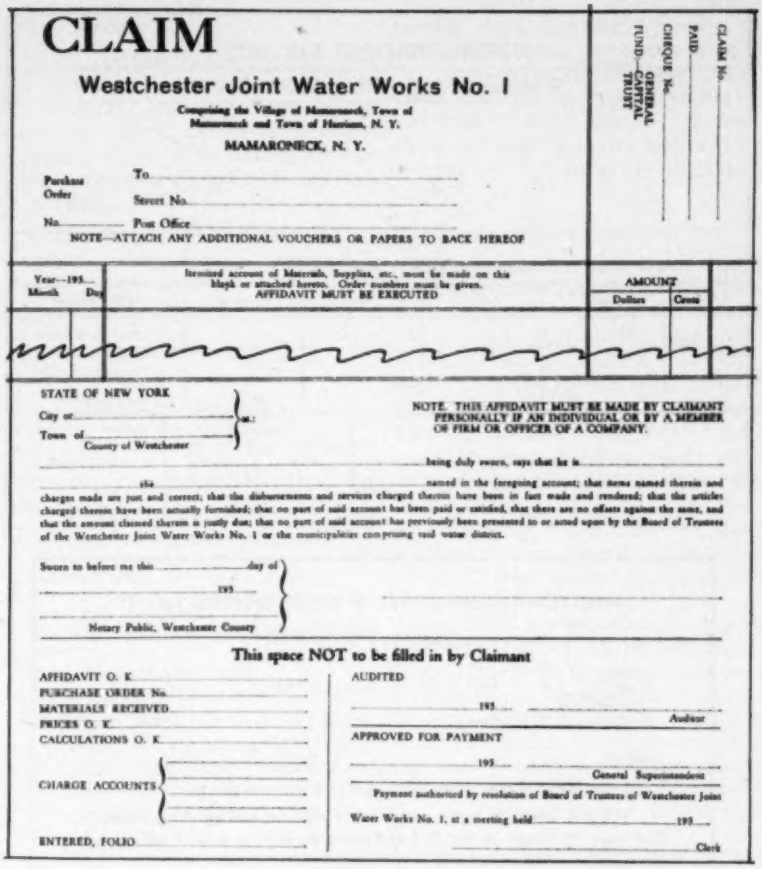
The copy of the installation card is given to the Junior Clerk, who copies the information on the proper ledger sheet, types a card to be used in the addressograph plate holder, and stamps an addressograph plate with the Graphotype machine. This plate is used for billing purposes and has embossed on it the builder's name, address, account number, and meter reading book and page number.

Since the builder has had the meter set, he includes the cost of installation in the price of the house. Therefore, the new owner must notify the Water Office of his purchase so that the records may be corrected. This notice is given to the Senior Stenographer, who mails an application to the new owner for his signature. When this is returned, the addressograph plate, meter reading book, and the ledger sheet are corrected, accordingly. When these corrections have been made, the meter installation is completed and so is the unique routine for new houses.

Billing Procedure

In contrast to the above, is the day by day, month by month routine. Although each house is billed once every three months, the staggering of the three districts makes billing a continuous procedure:

1. The consumer uses water for three months.



CLAIM

Westchester Joint Water Works No. 1

Comprising the Village of Mamaroneck, Town of Mamaroneck and Town of Harrison, N. Y.

MAMARONECK, N. Y.

Purchase Order No.

To

Street No.

Post Office

NOTE—ATTACH ANY ADDITIONAL VOUCHERS OR PAPERS TO BACK HEREOF

FUND—GENERAL CAPITAL TRUST

CHEQUE No.

PAID

CLAIM No.

Year—195... Month Day

Itemized account of Materials, Supplies, etc., must be made on this blank or attached hereto. Order numbers must be given.
AFFIDAVIT MUST BE EXECUTED

AMOUNT Dollars Cents

STATE OF NEW YORK
City or Town of
County of Westchester } ss.:

NOTE. THIS AFFIDAVIT MUST BE MADE BY CLAIMANT PERSONALLY IF AN INDIVIDUAL OR BY A MEMBER OF FIRM OR OFFICER OF A COMPANY.

being duly sworn, says that he is

the named in the foregoing account; that items named therein and charges made are just and correct; that the disbursements and services charged therein have been in fact made and rendered; that the articles charged therein have been actually furnished; that no part of said account has been paid or satisfied, that there are no offsets against the same, and that the amount claimed therein is justly due; that no part of said account has previously been presented to or acted upon by the Board of Trustees of the Westchester Joint Water Works No. 1 or the municipalities comprising said water district.

Sworn to before me this day of 195

Notary Public, Westchester County

This space NOT to be filled in by Claimant

AFFIDAVIT O. K.
PURCHASE ORDER No.
MATERIALS RECEIVED
PRICES O. K.
CALCULATIONS O. K.
CHARGE ACCOUNTS
ENTERED, FOLIO

AUDITED
195
Auditor

APPROVED FOR PAYMENT
195
General Superintendent

Payment authorized by resolution of Board of Trustees of Westchester Joint Water Works No. 1, at a meeting held 195
Clerk

Fig. 5—CLAIM form (8½ x 13 inches)

METER READING RECORD

Westchester Joint Water Works No. 1

METER RECORD

Size	Make	Number	Set	Removed	Why Removed

Date	Reading	Consumption	CHARGES Water	CHARGES Service	REMARKS
	OO	OO			
	OO	OO			

WESTCHESTER JOINT WATER WORKS NO. 1

Account No.....

Book.....Page.....

Date.....195.....

Premises.....

I was unable to gain admission to read your water meter today.

Will you kindly fill in the spaces below with the reading of your meter. (Just copy the figures on the dial) and return the card to us so it will not be necessary to estimate your bill.

Thank you.

METER READER

Fig. 6—METER reading record—above (6 x 9½ inches)

Fig. 7—METER reading card for householder—below (5½ x 3¼ inches)
Reverse side is self addressed postage paid permit

2. The meter reader enters the consumer's home and notes the dial reading in the meter book. If no one is home, the reader leaves a self-addressed postcard (Fig. 7) on which the occupant can copy the dial reading and mail it into the office.

3. When the reader has been through the meter book once, it is given to the Billing Clerk, who computes the metered water charges.

4. The Billing Clerk notes any houses that have been skipped and assigns service men to obtain the readings where no postcard is received. If this repeat trip to the house fails to obtain a meter reading, the bill is estimated.

5. The Junior Clerk prints the address of the consumer on a blank bill (Fig. 8) with the addressograph machine, checks the Billing Clerk's computations, and gives the checked book and the corresponding addressed bills to the Billing Machine Operator.

6. The Operator prints the account number, inclusive dates, before and after dial readings, consumption, charges, arrears if any, and the amount due on the bill. By a carbon arrangement this information is also printed on the corresponding ledger sheet, and on a proof sheet.

7. Next a check is made of the total consumption and money due from the meter reader's book against the total on the proof sheet, and the checked total is entered on a control sheet by the Billing Machine Operator.

8. The bill, plus a return envelope, is stuffed in an envelope, stamped, sealed, and mailed.

9. If payments are made by mail, they are separated into districts and labeled with the proper account number. If the payment is in person, the Cashier receives the money and posts it in the cash register.

10. Payments by check are posted in the cash register and the stub, half of the bill, put in the register drawer along with the checks. The other half of the bill is stuffed in an envelope and returned to the customer as a receipt.

11. At the end of each day, stubs are sorted into Districts, the total cash received for each District is entered in the Cash Receipts Book by the Cashier, and the stubs turned over to the Accounting Machine Operator. Daily receipts are then totaled, entered on a deposit slip, and deposited in the bank.

12. When the Accounting Machine operator receives the stubs, the amount of each stub is entered on its corresponding ledger sheet and a carbon copy of the entry is made on a proof sheet.

13. The totals on the proof sheet are checked against the total cash received for the day as shown in the Cash Receipts Book, and when agreement is reached, the proof sheet is stamped "control," the totals are entered, and it is filed.

14. Periodically all of the ledgers must be checked for delinquent payments, a bill being due the last day of the month following the one in which it is received.

15. The Accounting Machine Operator checks for lateness and if any is found, adds two per cent to the bill, makes out a collection slip, and gives it to the Bill Collector. The Collector visits the house resident and tries to collect the money.

16. At the end of each day the Cashier receives the Collector's money and handles it in the same manner as described above.

This completes the day-by-day routine, but one more item in the billing procedure should be mentioned. Once a year, each District requests the delinquent bills of that district as of a certain date and these are collected as a tax lien. In the areas served outside the three Districts, a deposit is required to guard against overdue bills.

End of the Month

Several reports and closing entries are made only once a month as follows:

1. The Stock Clerk makes out the monthly report of the material used in all of the jobs during the month.

2. The total month's consumption and money due from the control sheet are entered in the Journal.

3. The collection control sheet is reported to the Chief Clerk and is balanced against the total of the Cash Receipts Book.

4. The Billing Machine Operator checks the total of the outstanding balances on each account against the total outstanding balance on the control sheet of the next district to be billed.

5. The Cashier checks the bank statement and notes the outstanding checks.

6. Any adjusting entries due to adjusted accounts receivable, insurance payments, payroll distribution, and the like are entered in the Journal Voucher so that all accounts will balance.

7. The Utility repays the contractor (developer) a portion of the money he spent to construct the main. The repayment scheme varies from District to District, but essentially the developer gets a percentage of the receipts for a certain number of years.

8. The Utility pays the three Districts enough to defray the interest and redemption of the Water Works bonds. Water rates are fixed to cover operating costs plus the charges mentioned.

Other Services

Thus far this paper has outlined the office detail connected with installing services, billing and collecting, etc. The Utility also provides other services and the office force performs other duties that should be mentioned in passing.

1. Handling of complaints (Fig. 9)

a. High consumption
b. Low consumption
c. Dirty water
d. Poor pressure
e. Leaking meters
f. Noisy meters
g. Stuck meters

2. Handling of requests

a. Filling swimming pools
b. Change in size of service or meter (Fig. 10)
c. Rendering a final bill

3. Clerical work

a. Figuring salaries and overtime
b. Keeping records up to date
c. Keeping office supplies on hand
d. Taking care of all correspondence, reports and schedules
e. Keeping minutes of the Utility Board meetings.
f. Answering telephone calls

These duties and services are those of the office force. In addition there is, of course, the operating staff which performs the many tasks of collection, purification, and distribution of water, plus maintenance work including: Repairing leaks, checking hydrants, locating valve boxes, and testing, repairing, and replacing meters. Good public relations are considered important and "Willing Water" doorknob cards are used to keep customers informed of the progress of repair work.

Comment

It is not only the large water works, but the small ones as well which perform an amazing amount of service for so little cost to the consumer. While other costs have increased, water (and the service which puts it in the customer's home) is still inexpensive. Good as water service is, it could be better if water rates were increased but a fraction of a cent per person per day.

Considering the number of steps involved in the procedures outlined above, it may appear to the casual observer that the work is quite involved with the transfer of papers and reports from one person to another. This is not true; the procedure is much like a mass production assembly line with each worker doing a small job, and in its proper sequence these many small jobs accomplishing the major one, of keeping track of the supplying of water. When each

CASHIERS STUB

WESTCHESTER JOINT WATER WORKS No. 1
DISTRICT 4
Office – 129 Halstead Avenue
Mamaroneck, N. Y.

ACCOUNT No.	1953 FROM	1953 TO	Readings in Hundreds of cu. ft PRESENT	Readings in Hundreds of cu. ft PREVIOUS	CONSUMPTION IN HUNDREDS O CU. FT.	CHARGES METERED WATER	CHARGES MISCEL.	ARREARS	AMOUNT DUE

MAIL THIS COUPON WITH YOUR CHECK

RULES and REGULATIONS

Article 5

WATER BILLS

Sec. 1. Bills will be rendered at regular quarterly intervals and are due and payable within ten days from the date thereof, at the office of the Water Works. In case of failure to pay any bills within ten days after presentation or mailing to the last known address of the owner, the supply may be shut off and the meter removed without notice to the consumer.

Deposits are required of all consumers in District No. 4 at time of signing application for service.

RATE SCHEDULE – METERED SERVICE

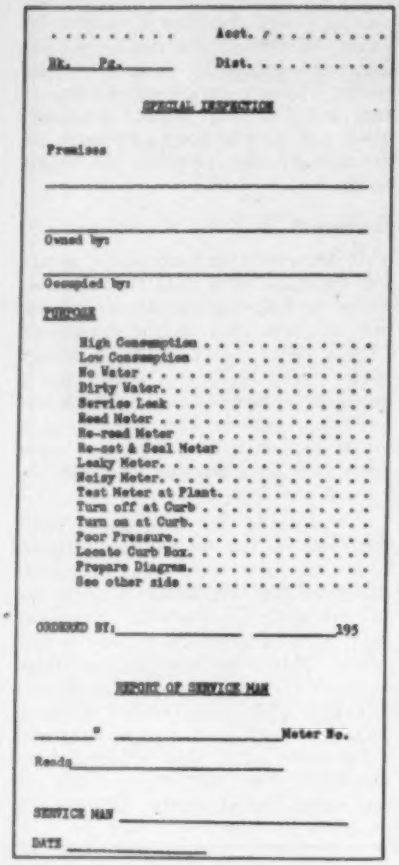
⅝ in. meters—$4.00 per quarters, for which 1000 cubic feet of water will be furnished.
For meters larger than ⅝ in. fixed service charges as follows will be made:

¾ in. meters	$2.00 per quarter	2 in. meters	$15.00 per quarter	6 in. meters	$120.00 per quarter
1 in.	" 4.00 " "	3 in.	" 30.00 " "	8 in.	" 180.00 " "
1½ in.	" 8.00 " "	4 in.	" 50.00 " "	10 in.	" 300.00 " "

In addition to the above fixed service charges, and for water used through ⅝ in. meters in excess of the quarterly allowance of 1000 cubic feet, water actually consumed will be charged for at the following rates.

For the first	5,000 cubic feet used within the quarter	33c per hundred
For the next	15,000 cubic feet used within the quarter	30c per hundred
For the next	30,000 cubic feet used within the quarter	25c per hundred
For the next	250,000 cubic feet used within the quarter	17½c per hundred
For all over	300,000 cubic feet used within the quarter	15½c per hundred

Fig. 8—WATER bill with rate schedule (9¼ x 7 inches)
Folds in middle at dotted line with carbon behind reading data to print duplicate on reverse of rate schedule.



. . . . . Acct. . . . . .

Bk. Pg. Dist. . . . . .

SPECIAL INSPECTION

Premises

Owned by:

Occupied by:

PURPOSE

High Consumption . . . . . .
Low Consumption . . . . . .
No Water . . . . . .
Dirty Water. . . . . .
Service Leak . . . . . .
Read Meter . . . . . .
Re-read Meter . . . . . .
Re-set & Seal Meter . . . . . .
Leaky Meter. . . . . .
Noisy Meter. . . . . .
Test Meter at Plant. . . . . .
Turn off at Curb . . . . . .
Turn on at Curb. . . . . .
Poor Pressure. . . . . .
Locate Curb Box. . . . . .
Prepare Diagram. . . . . .
See other side . . . . . .

ORDERED BY: _____ _____ 195

REPORT OF SERVICE MAN

_____" _____ Meter No.

Reads _____

SERVICE MAN _____

DATE _____

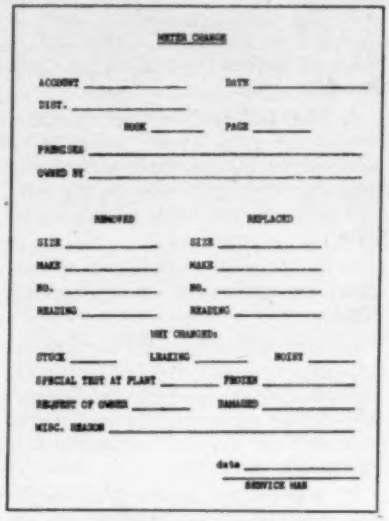
Fig. 9—COMPLAINT inspection record (4¼ x 11 inches)

person has a small routine function, it can be efficiently performed and this lends efficiency to the whole organization.

Two new procedures are being introduced to improve the Billing Clerk's work, which at the present time is relatively inefficient. As mentioned, this clerk not only has to calculate the bills by long hand, a tedious process whch admits error, but also assigns work to the Service Men. To eliminate this situation a new computing machine is being purchased to replace the present billing machine. This new machine will calculate the bills automatically as well as print the required information on the bills. Thus, the Billing Clerk can spend more time on handling complaints and give more attention to the Service Men.

Time now spent by the Billing Clerk on the assignment of Service Men is inefficiently used. As pointed out above, the Billing Clerk has to assign men to re-read the "skips" on which no postcard is received. At the present time, as a house is skipped the reader folds the page of the reading book and when a meter book is completed the Billing Clerk must go through it and write out an inspection slip for each "skip." These soon become a formidable pile of loose papers and confusion reigns.

To remedy this situation the Water Office is adopting a new style of reading book which has detachable pages in the front for "skips." Under the new system, as a house is skipped the reader notes the address and other pertinent information on this sheet in the front of the Book. At the end of the day this sheet is detached and handed to the Billing Clerk and thus



METER CHANGE

ACCOUNT _____ DATE _____

DIST. _____

BOOK _____ PAGE _____

PREMISES _____

OWNED BY _____

REMOVED REPLACED

SIZE _____ SIZE _____

MAKE _____ MAKE _____

NO. _____ NO. _____

READING _____ READING _____

WAS CHANGED:

STUCK _____ LEAKING _____ NOISY _____

SPECIAL TEST AT PLANT _____ FROZEN _____

REQUEST OF OWNER _____ DAMAGED _____

MISC. REASON _____

date _____

SERVICE MAN

Fig. 10—METER change record (5½ x 8½ inches)

all of the "skips" of one book are in one place. As meter postcards come in, the consumption can be noted on this sheet. When it is time for the Service Men to check the "skips," this one sheet avoids the necessity of having to write out slips for each missed reading. These two procedure changes will both be time-savers.

Acknowledgment

The author wishes to express his appreciation to the office staff of the Westchester Joint Water Works No. 1 for their assistance in preparing this article. Particular thanks are due to Superintendent George H. Straub and Assistant Superintendent Stanley A. Longhurst.

Water Supply for Field Forces a Problem in Korea

Wells a better source than rivers; freezing weather slows production

Supplying water for the 40th Infantry Division is a never-ending job of the 578th Engineer Combat Battalion in Korea. Even with adequate sources to provide all the water needs of the division, the 578th conducts a continuous search for new sources. They will serve as a "ready reserve."

Three sources furnish the two million gallons monthly consumption of the 40th, with one water source in reserve to handle emergencies. So many likely water sites have been pinpointed on the engineer maps that the battalion could set up on new locations and produce enough water for the division in as few as three to five hours. Water supply specialist of the Division is Cpl. Harry Yakimik, a New Jersey soldier.

Water turns up in the most unlikely places in Korea, defying many of the theories of water tables and terrain. The engineers have found water on mountain passes where, theoretically, it was impossible to find; and have drawn blanks in valleys whose terrain gave every indication of a plentiful water table.

If a well meets all of the requirements and an ample turn-around area is available for the vehicles, machinery is moved in and another water source is born. Before being used for drinking or cooking purposes, the water is filtered and pumped into a large tank for disinfection with chlorine.

Winter has shortened the working day of the water personnel, and has brought danger of freezing equipment. Each night the hoses must be disconnected, drained and placed near a stove to dry, while tanks and pump engines have to be drained to protect them from freezing cold.

Cpl. Yakimik points out that he is strictly a "well-man," as opposed to the "river-man." He prefers wells to rivers as a water source because wells are immune to freezing in the winter, and rainfall will not cloud the water with mud. Wells are unaffected by the changing seasons. A little more work is required in setting up a well supply, but it pays dividends.

The average soldier requires from three to five gallons of water each day. The water supply specialists are the men responsible for maintaining water supplies in the field.

None of us can escape the responsibility of tomorrow by evading it today.—*"Abe." Lincoln.*

Operation of Small Water Works

Reorganization and Reconstruction

One of a Series*

by A. E. CLARK, Manager, Nashville, Suburban Utility District, Nashville, Tenn.

REORGANIZATION of a business can be termed "reconstruction," since such designation seems to fit many cases better than mere reorganization. Especially is this true when such rehabilitation is made necessary because of lack of sufficient finances with which to maintain the system against deterioration. It is safe to say that the majority of reorganizations are prompted for financial benefit. We usually think of reorganization as applying to private business, but this is not necessarily so, since many water utilities would benefit by this same procedure and many have passed through it with very excellent results. Finally the whole question centers around management and policy, either of which can be responsible for a "reconstruction" either partial or complete. In some cases a reconstruction poses a problem to determine where to start, especially if all phases of the water utility need revamping. The problem becomes more acute if it has to be done during an expansion period.

The following is a brief outline of just such a case. Starting with the premise that a water utility in order to operate efficiently, provide proper service and maintenance, as well as to make provisions for expansion etc., must operate as a business. There must be sufficient return on the investment to provide the above items plus debt service.

A Case at Point

A water utility had been allowed to run down due to a variety of reasons. Necessary improvements had not been made and no definite maintenance procedures had been set up. Along with this, proper supervision was not exercised over either the field or office. This made for inefficient operations in both. To name a few of the difficulties encountered, there was a lack of records, equipment was not kept in repair, meters were allowed to remain dead and minimum bills rendered and flow meters in the pumping stations were not operating. There were no recording pressure gauges in the pumping stations. In other words no immediate information was available as to the pumping operations. The meter books in some cases were used as ledger sheets. The records that were kept were not kept current. So that, in general, conditions were such that a reconstruction was in order. It didn't make too much difference where the start of the reconstruction was made because all procedures had to be revamped.

The personnel was a good place to start. The personnel in the field and office was not in balance, having too many in the field and too few in the office. A study of the work indicated that if 50% of the field crew was terminated and an additional clerk added to the office staff a proper balance would be obtained. So much for personnel.

Studies of field procedures showed a lack of work planning; transportation equipment was not suited for the work; lack of records; meter repair parts not in stock; lack of organization and supervision. The first thing was to organize the field crew by putting them under proper supervision, followed by organizing the work and setting up a scheduled routine for daily recurring procedures. Forms were drawn up and mimeographed to keep records of work, etc. The forms were mimeographed so that after a period of use indicated changes could be made before permanent printed forms were purchased.

Metering Procedure Revamped

A check was made of the meter repair shop and sufficient spare parts ordered; meters which had been changed and not repaired were sorted out, scrapping those which were obsolete and keeping those for repair which would come within the economic cost. This involved considerable paper work inasmuch as there were three makes of meters and seven different types. Quite a number of obsolete meters were in service. One man was sent to a well operated meter shop of a large water utility for training in this work. This was money well spent because aside from good training in meter repair work it equipped him to train others in this work. Getting the meter end of the utility to operating satisfactorily took some time. A check of the meter reading books furnished a list of dead meters and so many slow ones which amounted to quite a figure. However, after these were changed the work dropped off considerably and one man was able to do the repair work from month to month, keeping all dead and slow meters repaired. Changing meters was done by a utility man and his other duties consisted of rereads, pressure and flow tests at residences, checking for leaks at residences, etc.

In order to obtain information regarding pumpage one flow meter was returned to the factory for overhauling and a supply of charts ordered. After putting the two flow meters in operation some definite information in regard to pumping was available. Shortly thereafter, recording pressure gauges were installed to supplement the data from the flow meters.

Improved Storage

There was inadequate storage, consisting of one standpipe with a capacity of 250,000 gallons and another with a capacity of 22,000 gallons. In order to correct this condition a new concrete reservoir was constructed with a capacity of 2,000,000 gallons. Previous to construction of the new reservoir elevations in the standpipe were controlled by mercoid switches. Alone, these were not satisfactory. A Golden-Anderson altitude-valve was purchased for installation at the 250,000 gallon standpipe. After installation of this valve much more satisfactory operation of the pumps was obtained.

Transportation was another problem. There were two sedans, one ½ ton pick-up truck and one three-

*This is another of the popular series of articles by Mr. Clark dealing with problems in the management and operation of the small water works. Others are to follow.

quarter ton truck. The trucks were costing considerable for maintenance and of course the two sedans were impractical for anything but personnel transportation. One sedan and the pick-up truck were traded in for two new ½ ton pick-ups and as soon as funds were available the three-quarter ton truck was traded in for a one ton dual wheel stake body truck. This now provided equipment that could be used for the jobs which a water utility has to do.

Machines vs. Manpower

An air compressor is a necessity and the one in use had seen its best days. It was in the shop for repairs much of the time and was of too low capacity for the work. This was traded in on a new compressor with larger capacity and more sturdy construction. This equipment has proved very satisfactory with very low maintenance cost.

Since reorganizing or reconstructing the field operations it has been found that about 50% more work has been done with 50% less personnel than before.

Revamping Office Procedures

The reorganization of the office procedures as just as drastic as the field.

The billing operations were studied first. Previous to the reorganization the billing was being done by a private organization using the punch card system. The bills themselves were a punch card utilizing different colors for different billing classifications. The consumers made numerous complaints usually because of not understanding the bills. The organization doing the work had not done this before and consequently caused quite a bit of confusion. It was determined that with the use of a billing machine and addressing equipment the work could be handled at a lower cost. After studying the various procedures it was decided to use individual customer ledger sheets and post card bills. There were a number of reasons for this, the primary one being that the history of a customer's account is readily available. The machine purchased posted the ledger sheet at the same operation that the bill was printed on the post card. The same machine is used for the posting of the accounts receivable as well as intermediate and final bills, which of course are accounts receivable but of a different classification. Arrears or credits are also posted and printed on the bill. This billing procedure has proved very satisfactory.

Reference has been made to the meter reading books. These were studied more in detail and one amusing discovery was that in many instances the meter reading sheets were used as ledger sheets, showing arrears due, etc. The meter sheets ran out a short time after this study was made and a new sheet was designed to provide much needed information relative to changing tenants, changing meters, etc., and at the same time the sheets provide a longer reading period, in other words, it is not necessary to make up new sheets as often.

There was a woeful lack of records and this may have been partly due to lack of sufficient forms. It is very easy to accumulate too many forms and make the office records a burden with unnecessary information. There should be enough forms and properly designed to provide the needed information with the elast effort. If the required information is available then a great deal of time is conserved which would be used in trying to find material that should be in the files. As an example, field orders were designed so that the usual information required meant checking one or more of a list of items shown on the form. It is in duplicate and the duplicate is filed in the office until the original is returned completed. The shop records which are submitted to the office each day consist of time distribution job sheets and new meter connection sheets. Other less used forms are available for use. The same applies to the office. Forms have been provided for various uses as inter-office forms but which make a record of any transaction important enough to record. A review of these forms might mean little to another water utility but they do serve the purpose in the utility where used.

The bookkeeping procedures are set up in accordance with those recommended by the A.W.W.A.

All bills are sent out the same date each month allowing ten days in which to pay the net amount after which a penalty is added. All accounts are checked regularly for non-payment and necessary forms sent out to delinquents. After a definite time a "Cut-Off" notice is sent and unless the bill is paid the service is discontinued.

The water utility is now operated as a business as all water utilities should be and the results being obtained reflect the difference, both in revenue, maintenance, operation and service plus better public relations.

Water Meter Purchases to be made on basis of "Impartial Tests"

A Minneapolis, Minn., city council committee has ordered "impartial tests" in an attempt to settle a fight over the purchase of water meters by the city.

At the suggestion of City Engineer Hugo Erickson, the public grounds and buildings committee voted to ask Twin City Testing and Engineering Laboratory to check meters offered by the low bidder against city specifications.

"We have a difference of opinion here as to whether these meters meet specifications," he said. "Our department tests indicate they do not. Instead of charges, counter-charges and playing politics, we should have an impartial test."

"We may be a small town with a small reservoir; but, I want you vacationists to know it ain't no swimmin' pool!"

Water and Sewage Charges in Bayonne are Double the Water Rate

The 14,000 water meters of Bayonne, N.J., will be checked and readings taken in preparation for the new system of double-billing for water and sewage disposal service that will be in effect after April 1.

The water and sewage disposal system was combined as one utility this year. It was decided at the time that the best method of meeting the cost of the $10,000,000 sewage disposal system and operating the water department would be by doubling the water rate.

When you know how to spend less than you get, you've the philosopher's stone.—*Ben Franklin*

A Dedication

When Chester Morse died on September 21, 1949 in his 76th year, Seattle lost an exceptional superintendent of waterworks; and, the world lost a fine citizen.

Since Mr. Morse served the American Water Works Association well as a member of the Board, representing his Pacific N.W. Section for a three year term 1944-1947; and, because the Association is holding its 74th Annual Convention this month in Seattle, it appears to us entirely appropriate that we pay to him tribute as an outstanding waterworks man. To the memory of W. Chester Morse we dedicate this 1954 AWWA Convention Issue and its companion Annual Reference and Data Edition.

Christened William Chester Morse, he was born in Evanston, Ill., on Aug. 15, 1874. At the age of 9 his family took the pioneer trail to Seattle, Wash., and settled there. At the age of 18 he left the family roof to become a homesteader on his own. The location was on Cedar Lake, which later became a tributary to Seattle's water supply—then, as now.

Mr. Morse was a self-taught civil-engineer, having completed the courses of the International Correspondence School. Having established himself professionally in the Northwest by 1921, he was elected to full membership in the Am. Society of Civil Engineers. He became a recognized authority on earth movement and in water supply undertakings.

Mr. Morse's first municipal service dated from his appointment as City Engineer of Seattle in 1927. He returned to private practice and was called to Hong Kong in 1935 by the British Government to study and report on earth movement problems.

In 1938 he was again called for municipal service and accepted the post of Superintendent of Water for

W. Chester Morse
1874—1949

Seattle. This position he held until his death on Sept. 21, 1949, whereupon the City Council elevated a capable son, Roy W. Morse, to succeed an illustrious father as head of the Seattle Water Department.

Mr. Morse enlisted as a buck private in World War I but rose through the ranks to come out as a Major of Field Artillery—no mean accomplishment in the first World War.

Upon the passing of Mr. Morse, the City Council of Tacoma, as well as that of Seattle, passed resolutions recognizing his capable public services over the years. He had served for four terms as Chairman of Seattle's Board of Public Works and the Mayor of Seattle, W. F. Devin, proclaimed that "no man has filled so many important posts in the interest of this City. Seattle has never had a more effective and valuable official or Civic leader than Chester Morse. His death is an irreparable loss. He cannot be replaced."

Mr. Morse was amongst the first members of the Am. Water Works Assn. to be voted the George Warren Fuller Award in recognition of his leadership. As a member of the Association's Board of Directors, he proved his ability as the solid man that he was. When he spoke he was carefully listened to, for he always had something to say. Of great value was his analysis of difficult situations and kindly but firm thought molding, reasoning, opinions, suggestions and recommendations. These came out of keen vision and experienced thinking.

Knowing something of the operations of the Seattle Water Department, it is this writer's opinion that Chester Morse was one of "the greats" as a water works manager. He was all that the people of Seattle thought of him; and all that his Mayor said of him upon his passing.

As a valued contributor to its pages in the past, it is a privilege to dedicate to his memory this Seattle Convention Issue of *Water & Sewage Works*.

New Water Rates to Finance Los Angeles Supply

New schedules of water rates for Los Angeles, adopted by the Board of Water and Power Commissioners and approved by the City Council and Mayor, will be reflected in water bills dated on and after April 1, 1954. The changes will result in a general increase of about 17 per cent in water revenues, with an average of about 67 cents per month being added to water customers' bills.

The water rate increase is the first for Los Angeles in fifteen years. Municipal water rates were last raised in 1938, then reduced in 1942 and 1943, and have remained at the reduced levels through more than ten years of rising inflation.

For domestic, commercial and industrial service within the city (serving about 97 per cent of all water consumers), the basic quantitative rate will increase from 14.8 cents to 16 cents per 100 cubic feet of water; the present minimum charge will be eliminated and a new service charge instituted; the basic minimum charge of $1.10 being dropped and a basic service charge of 48 cents per month being established for meters of one inch or smaller.

"Larger revenues are urgently needed to maintain the municipal water service and finance the tremendous extension and expansion of water facilities to meet the city's rapid growth and increasing demand for water," according to Samuel B. Morris, general manager and chief engineer of the Department of Water and Power. Mr. Morris explained:

"Los Angeles is in a semi-arid land, our water has to be 'imported' by long aqueducts, and we must keep large quantities in storage to be sure of having an ample supply at all times. In addition, our city is growing at a tremendous rate."

Dallas Water Department to have Business Manager

The hiring of a business manager to supervise the city water department's growing collection and accounting division has received informal approval of the City Council.

This reorganization in the water department was recommended in an independent audit of city operations made by a consulting accounting firm.

The plan calls for the business manager to be an assistant to Waterworks Supt. Karl Hoefle and to reorganize the department business office.

WATER WORKS PRACTICES

Design Criteria

Part I

The Eleventh of a Series

by **GEORGE E. SYMONS,** ***Ph.D., Consultant & Technical Editor,***
Larchmont, N. Y.

SEVERAL factors affect the basis of design of any water supply or water purification plant. These design criteria include: Capacity Requirements, Source of Supply, Treatment, Pressure and Power, Equipment, Distribution, Architectural Consideration, and Personal Preferences of Designer.

A . . . Capacity Requirements

1. . Present Status

a. It is axiomatic in the U.S. that a community requires an ample water supply for present and future needs. There are few cities in the U.S. of more than 1000 population that do not have a water supply system.

b. Design considerations will differ somewhat depending on whether the supply and system is entirely new or an extension to an established system.

(1) An entirely new community can design a completely integrated system, using the latest developments in equipment.—Such a community was Levittown, Pa., which grew from nothing to 16,000 homes (about 70,000 persons) in three years. Suburban developments sometimes fall in this category, as do communities which are developed in connection with new industrial locations.

(2) Old communities, which must extend or enlarge a water supply system, are confronted with the problem of integrating new equipment with existing facilities and must design accordingly.

2. . Basic Unit of Design

a. In planning any water supply system, new or enlargement, a basic unit of capacity must be used in the design criteria. The unit most commonly used is expressed as the annual average gallons per capita per day (gpcd) and is obtained as follows:

$$\text{gpcd} = \frac{\text{annual water use in gallons}}{365 \times \text{population}}$$

b. The gpcd unit varies widely from one community to another depending on many factors such as type of community, use of water for domestic, commercial and industrial establishments, leakage, etc., and the value varies from year to year with a tendency to increase.

c. In 1900 the basic unit value for the entire U.S. averaged about 90 gpcd. In 1940 it was about 127 gpcd and in 1954 the AWWA estimated the figure at 140 gpcd. It has been estimated that in 1975 the average water consumption per person in the U.S. will be approximately 155 gpcd.

d. Reasons for these variations and methods for developing a value for a particular location are presented in later sections on Consumption Factors and Quantity Consumption Data.

3. . Future Period

a. Most important in any consideration of design criteria is the period in the future for which the design must be developed. That future date depends on two factors: (1) Probable life of that part of the system being planned, and (2) how the construction is to be financed.

b. If the proposed addition be long-lived and benefit future generations, it should be planned and financed for a distant date, so that present generations will not be saddled with too much cost for benefits to those who come after.

If the expansion project has a relatively short life, it should be planned and financed accordingly, but it is unwise and uneconomical to plan and build for a very short period.

If the project is to be financed by a bond issue to be retired out of earnings or by general obligation bonds, the property life should be no less than the bond life. If the project is financed out of surplus, its life should be equal at least to the period required to rebuild that surplus out of future earnings.

c. Ten years is probably the shortest period to consider as sound planning; some states put a 20-year legal limit on municipal bonds; 30 years is probably not too long to plan for facilities which have a history of long life, such as cast iron pipe water mains.

d. If the project or structure is designed to last during the life of the bonds, those people paying for it have its use at no unfair financial burden on themselves or succeeding generations. This attitude, of course, applies to municipally owned utilities, but the reasoning can easily be adapted to private utilities.

e. Prof. Ernest Steel suggests these design periods:

(1) Source of supply—individual wells, 5 years; dam and impounding reservoir, 25 to 50 years.

(2) Pipe lines from source to city —depends on probable life of pipe used, but generally plan for 25 years or more.

(3) Treatment plant—10 to 15 years, but provide for future expansion.

(4) Pumping plant—10 years.

f. Having determined the period for which the expansion or construction is to serve, the next step is to

This article is one of a series on the general subject of "Water Works Practices," developed by Dr. Symons in the simple style of a short course lecture and designed to be of interest to small plant operators, new operators, students and many others who may wish to review the fundamentals of the subject.—*The Editors*

estimate the capacity required at the end of that period.

This estimate will depend on two factors: (1) Population at that future time, and (2) per capita consumption at that time.

4. . Population Predictions

a. Prediction of the population to be served at the future date for which plans are being made is generally made on the basis of past census history, modified by such factors as may be foreseeable.

b. Methods used to forecast population growth of cities include:

(1) Arithmetical Progression—The additional of a constant number for each year.

(2) Uniform Percentage Growth—Also called "geometrical progression"; the addition of a constant percentage growth, compounded yearly.

(3) Decreasing Rate—Also called "decreasing rate of increase" and "decreased rate of growth"; the addition of a constantly decreasing percentage growth compounded yearly.

(4) Graphic—Also called "curvilinear method"; the plotting of a curve for growth for past decades (Fig. 1) and projecting the curve into the future based on its past characteristics.

(5) Graphical Comparison—Population curves are compared graphicallv with those of similar but larger cities. In this case the curves for several larger cities are superimposed on that of the city under study, at the point of equal population. From the trend of the several curves, the probable trend line of the city under study can be sketched.

(6) Logistic Method—Population growths are predicted on the logical theory that cities as well as the country will reach a saturation point, which can be determined from a logistic grid. This method developed by Velz and Eich (See: "How Old Are Our Cities," *Civil Engineering*, Oct. 1940) plots a coefficient of growth as percentage of saturation vs decades before or since 1940.

c. Actually, the growth of a city may be influenced by many factors: Age, local conditions, development or decline of industry, transportation facilities, social and political trends, such as movement to suburbs.

All these intangible factors must be taken into consideration and the future estimate and projected population curve adjusted accordingly, where possible. Typical population growth curves are shown in Fig. 1.

d. Basic data on population can be obtained from the decennial U.S. census. If interim estimates are necessary to determine present status, four methods may be used.

(1) Straight line projection of curve between last two census figures.

(2) City directory data.

(3) Ratio of population to enrolled school children in the last census year applied to current school enrollment.

(4) Ratio of population to telephone services in the last census year applied to current telephone services in use.

e. Whatever the population prediction, it is good engineering practice to plan future facilities for a population greater than the predicted value, or to plan for future expansion in case population growth and water demand become appreciably greater than predicted.

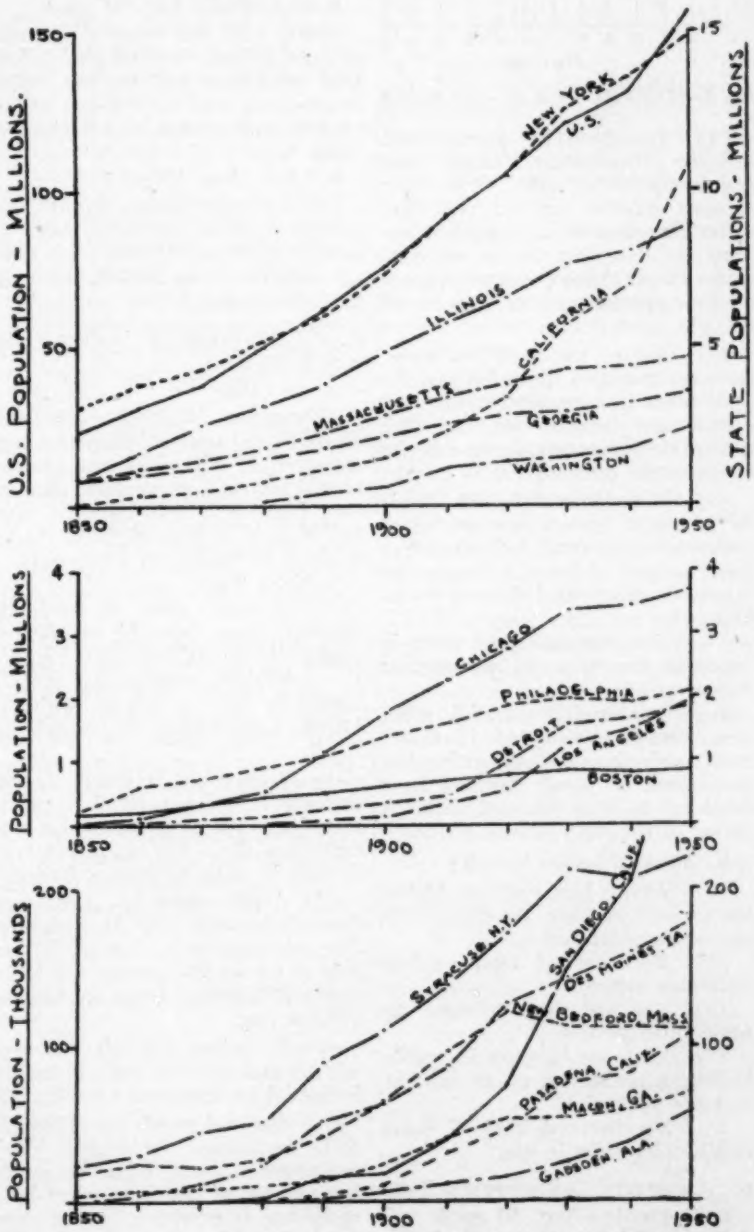
5. . Consumption Factors

a. *General factors* include:

(1) Size of city both present and future..

(2) Character of community—Is it residential, residential and commercial; residential commercial and industrial.

(3) Kind of industries in the community.



Courtesy Prof. H. M. Gift, Cornell Univ.

Fig. 1—POPULATION records in United States

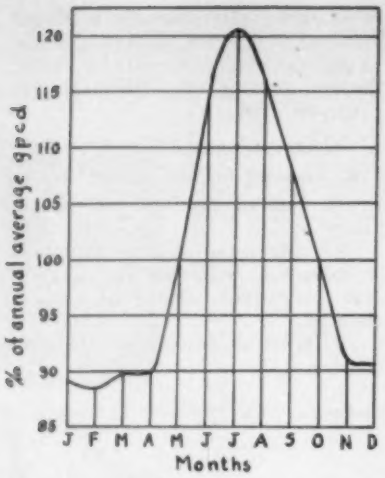


Fig. 2—SEASONAL trends in water demand

(4) Climate—The greater the average temperature range, the greater the use of water. Where the summer months are hot and dry, water consumption will increase appreciably (See Fig. 2). Water consumption per capita is greater in areas of low rainfall and in periods of drought.

(5) Cost of water—When water rates are increased, there is generally a decrease in consumption and the greater the increase in rates, the greater the percentage decrease in per capita water consumption.

(6) Miscellaneous factors—quality of water, sewers, average water temperature, amounts of detergents used, number of home softeners, attitude of utility toward lawn sprinkling, etc.

———When the quality of water is improved, the per capita consumption increases.

———Unsewered residential areas have shown averages of 13 to 40 gpcd, while the same areas after the installation of sewer systems have increased to 30 to 88 gpcd, within a period of ten years or less.

b. *Specific factors* include:

(1) Service pressure; the higher the average pressure, the greater the per capita consumption.

(2) Per cent of total services which are metered.

(3) Loss and waste tolerated by utility management.

(4) Public use of water for public buildings, sprinkling, street flushing, and fire protection.

(5) Number and kind of water conditioning units in use.

6. . QUANTITY CONSUMPTION DATA

a. Domestic—Avg. 50 gpcd

Residential uses of water including drinking, cooking, laundering, toilet flushing, bathing, and lawn or garden watering, will consume from 10 to 60 gpcd.

b. Commercial—Avg. 20 gpcd

Places of business, office buildings, wholesale and retail stores, services, etc. will use from 10 to 35 gpcd. Where air conditioning units are installed, commercial use may average more than 20 gpcd.

c. Public—Avg. 10 gpcd

Public office buildings, schools, garages, other public institutions, swimming pools, drinking fountains, sewer flushing, and fire fighting require from 4 to 12 gpcd.

d. Industrial—Avg. 30 gpcd

Water used for industry depends on types of industry and total industrial production and the per capita consumption will vary widely. Data on industrial consumption is given in Table 2.

e. Loss—Avg. 10 gpcd

Leaks in water mains, services and unauthorized use of water may run as high as 30 gpcd. Water main leakage may run from 2000 to 3000 gal per mile per day.

7. . VARIATIONS IN WATER CONSUMPTION

a. By Cities

Schroepfer, in 1945 (JAWWA *40*,165;1948) analyzed the water consumption of 398 cities and showed annual average consumption values to vary from 64 gpcd in Oshkosh, Wis. to 394 gpcd in Niagara Falls, N. Y., a highly industrialized community.

b. With Time

(1) Seasonal rates in temperate climates range from 85 to 130 per cent of the annual average .(Fig. 2).

———Highest consumption usually occurs in July or August, with the lowest consumption in March or April.

———Winter use is usually higher than that in spring, particularly where metering is not complete and flat rate customers allow services to run continually in order to prevent freezing.

(2) Daily rates in gpcd vary through the week (Fig. 3), with Sunday consumption as low as 80 per cent of the weekly average and Monday and Tuesday being as high as 105 per cent.

———Variations through the week will depend on tvpe and amount of industrial production in a community.

———Seasonal trends are evident in daily variations, the highest day's consumption usually occurring on the hottest day of the year when lawn sprinkling is greatest. On the other hand, the coldest day of the year may have a high consumption where flat rate services are allowed to run continually.

(3) Hourly rates in gpcd reflect the living and working habits of a community. As indicated in Fig. 4, hourly rates may run from a low of 30 per cent (or even lower in some communities) to a high of 180 per cent. Low consumption rates will occur some time between midnight and 6 a.m. and the high rate some time after 7 a.m. A secondary peak usually appears in midafternoon or early evening.

———The average hourly variation, however, is not always a safe basis on which to determine design criteria. On peak days, the normal hourly rate may be as high as three times the average annual gpcd rate. As design criteria, it is safer to base maximum hourly demands at 300 to 400 per cent of the annual per capita average consumption.

(4) Television and radio listening habits of a community's residents affect consumption rates. Water consumption rates have always dropped markedly when important events have been broadcast by radio. Extremely low consumption figures were observed throughout the nation on such occasions as the Tunney-Dempsey "long-count" fight, the abdication speech of King Edward VIII, Churchill's "Blood, Sweat and Tears" speech, and the inaugural addresses of Roosevelt and Eisenhower.

———Water consumption as affected by television has a definite pattern. There is a gradual decrease in consumption below normal during each half-hour time segment in the evening, with a sudden increase above normal at the end of each half hour.

———For extremely popular television programs, the decrease in consumption is abrupt at the beginning of the program and remains well below normal for the duration of the program, followed by an abrupt and above normal increase at the end of the program.

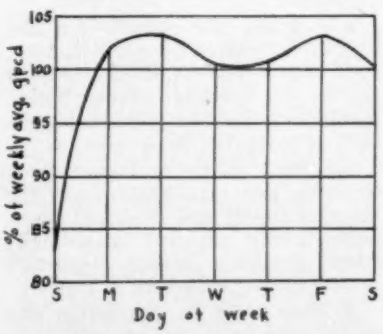


Fig. 3—DAILY variations in water demand

Table 1
RELATION OF CONSUMPTION TO METERING

% of services metered	No. of Cities	Range
0-10	79	160 to 218 gpcd
11-20	26	143 to 199
21-30	22	128 to 208
31-40	22	108 to 170
41-50	16	88 to 160
51-60	23	140 to 165
61-70	22	91 to 119
71-80	30	84 to 140
81-90	50	79 to 126
91-100	145	91 to 97

———Since the use of water by the viewing public at these intervals is largely for drinking and toilet flushing, it has been proposed that television programs can be rated by this "Teleflush System."

c. Fire Protection

(1) Demands for and use of water for fire fighting overrides normal expected variations in water consumption in a community. Any water supply must be capable of furnishing the maximum possible demand for fires.

(2) Since fires may occur at times of maximum hourly rates, the capacity of water works facilities must consider the maximum possible hourly rates in gpcd plus provisions for fire demand. Usually the average hourly high, rather than the single hourly maximum value is used as a basis for such calculations (Fig. 5).

(3) The National Board of Fire Underwriters recommends that the rate of flow to be supplied to a community, *in addition to regular uses,* should be related to the population by an empirical formula:

$$gpm = 1020\sqrt{P}\,(1 - 0.01\sqrt{P})$$

where P = population in thousands

(4) The total volume required in any one day is based on this flow for a continuous period of five hours for communities below 2500 population and for 10 hours for larger cities. (See Fig. 5)

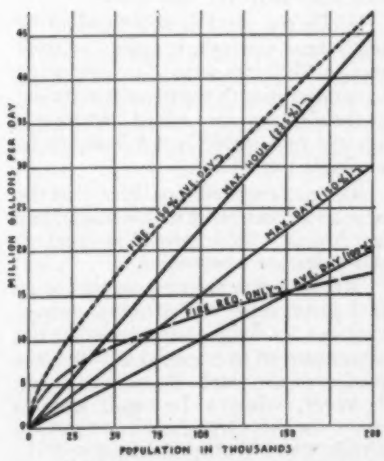


Fig. 5—WATER demand rates
Domestic, fire and combined fire and domestic rates (After Howson)

(5) Storage capacities necessary will depend on pumping capacity available in relation to fire demands. The subject of storage is discussed more fully under the topic on distribution systems.

(6) For a community of 16,000 persons with an annual average of 140 gpcd, the capacity required to meet fire demands would be

$$gpm = \frac{(1.8 \times 140) + 1020\sqrt{16}}{(1 - 0.01\sqrt{16})} = 252 + 3917 = 4169$$

(7) Where separate fire systems are available, these provisions for fire demand will apply only to the fire fighting system.

(8) Since fire insurance rates for a city are influenced by a water supply's capacity to meet these Fire Underwriters' requirements, it is desirable for the utility facilities to be designed to meet these requirements.

d. Character of Community

(1) Cities and districts in cities differ in water requirements according to character: residential (high vs. low income), apartments, commercial, or industrial.

(2) High income residential districts may use up to 125 gpcd as opposed to low income areas with consumption rates of 30 gpcd or less.

(3) Apartment dwellers will average 60 to 65 gpcd, while multiple family dwellings will run from 30 to 50 gpcd with a general relation to income levels.

(4) Commercial establishments will use approximately 300 gal per 1000 sq ft of floor area. Hotels average about 400 gal per day per occupied room, but this value varies widely depending on the type of hotel. Hospitals average 135 to 150 gal per day per bed.

(5) Industrial use varies so widely that no general rules can be given. Individual variations in several industries are discussed later.

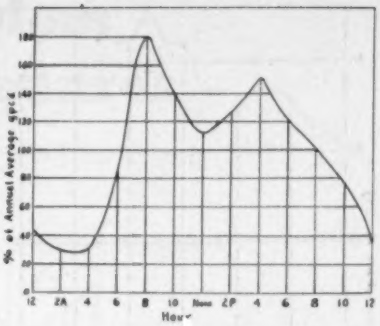


Fig. 4—HOURLY trend in water use
Note: Peak and minimum values vary in value, time of day and season of year; and from city to city

e. Pressure

(1) Rate of water consumption is directly affected by water pressure in the system. Up to 30 per cent more water has been pumped with an increase in average pressure from 25 to 45 psi.

(2) Design criteria should consider the lowest pressure that will give satisfactory service and the increased usage when pressures are increased for fire fighting use.

f. Metering

(1) The average annual per capita consumption bears an inverse relation to the per cent of services metered, with the per capita consumption decreasing as the per cent of metered services increases. (See Fig. 6.)

(2) Data collected by *The American City* from 435 cities are shown in Table 1.

g. Industrial Effects

(1) The water intake for industrial purposes varies widely according to the type of industry and depends somewhat on the locality and availability of water. Where water supply is limited, conservation practices, particularly for cooling water, may reduce the water intake to a marked degree, while the actual use per unit of product remains the same.

(2) Data on industrial water intake were published in Dec., 1953, by the AWWA in *"Willing Water No.*

Table 2
INDUSTRIAL WATER REQUIREMENTS

Industry	Unit	Gal water required*
Alcohol	gal	120
Bread	ton	500-1600
Canning	100 cases**	750-25,000
Coke	ton	1500-3600
Laundries	ton	8600-11,400
Meat Packing	ton live animal	4130
Milk Products	ton	4000-9000
Paper & Pulp	ton	4000-133,010
Petroleum Products	100 bbl	15,000-1,500,000
Soap	ton	500
Soda Ash	ton	18,000
Steel	ton	15,000-110,000
Sugar	ton	1000-2160
Textiles	ton	18,000-160,000

* Covers various products and processes involved
** No. 2 cans

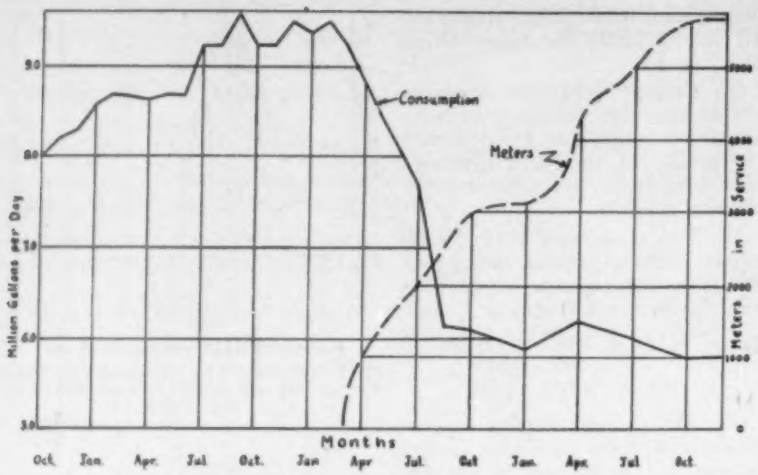


Fig. 6—RESULTS of metering a water supply

25." The wide range of water requirements are indicated in the data in Table 2 taken from that tabulation.

h. Air Conditioning

(1) The demand for air conditioning is seasonal and the greatest load is imposed on the hottest day in summer when the normal consumption is usually highest.

(2) Growth records of air conditioning installations must be given full consideration in planning for future water supply capacity.

(3) Water requirements for air conditioning equipment varies depending on temperature of air, temperature of water, and whether or not the units are equipped with conservation devices.

(4) Philadelphia, in 1953, estimated probable consumption without and with conservation measures.

	gpm per ton of refrigeration	% of total city consumption
Without conservation	2 to 3	33%
With conservation	0.05	0.1%

References

Material for this lecture was based on current literature and standard reference texts which will be listed at the end of Part 2 of this subject.

NEXT LECTURE

The subject of design criteria will be continued as Part 2 in the next issue and will cover: source of supply, treatment, power, equipment, distribution, etc.

Early "Pinetree Pipeline" in Georgia

In the early 1800s Augusta was a town with "growing pains." Increased population brought prosperity, but it also brought new civic problems. Freshets came now and then and the dirty waters of the Savannah River polluted the drinking water supply. Fever epidemics having taken a heavy toll of life on three previous occasions, the city fathers determined to establish a waterworks system that would prevent another outbreak. The fact that iron pipes were unavailable didn't deter them in the least. They had pine trees cut, hollowed and covered with pitch; fitted together they formed a wooden pipeline that brought clear, pure water from a great spring that was located out of the danger zone.

[Ed. Note: This story and drawing from "Know Your Georgia," by C. J. Holleran, appeared in the Atlanta, Ga., *Constitution*.]

Pipe Lack May Delay Sewage Treatment

Salt Lake City will be unable to use its new $594,000 sewage plant for the better part of a year after it is completed, according to a report by City Engineer Roy W. McLeese.

While the plant is scheduled to be ready next summer, it cannot be used until a $700,000 sewer is constructed to connect it with the present terminal at the old plant. He added that money for the new sewer is not likely to be available until 1955.

The city engineer predicted that the new treatment plant will be completed by August, 1954, providing current schedules are maintained.

Mr. McLeese pointed out that original plans were to draft this project, contract for the pipe and complete the sewer project to correspond with completion of the plant. Plans were upset, however, when a four-mill levy to cover the pumping plant and the City Creek water treatment plant was invalidated by the Utah Supreme Court, throwing the city one year behind in its financing of such projects.

Canning Plant Waste Problem Solved by Simplified Procedures

Vibratory screening and nitrate treatment aids condition of low flow stream

by R. S. INGOLS, H. W. HODGDEN, and H. E. MILLER,* Eng. Expt. Sta.
Georgia Inst. of Technology, Atlanta, Ga.

SEWAGE and waste treatment problems in Georgia involve at least one factor which is dissimilar to treatment problems in other states, although, of course, there are many similarities. The railroads of the State are built on ridges or divides instead of in river valleys. As a result, many medium-sized and a few large cities have developed on head water creeks, so small that they provide practically no dilution for sewage and waste disposal. The main line railroad (Central of Georgia), on which the city of Griffin has grown, does not have a bridge or culvert on the ninety miles of track from Atlanta to Macon.

The canning plant of Pomona Products Co. (sponsors of this study) is less than one mile from the railroad, and is located on a creek having much less than a square mile of drainage area. The pollution effect of its wastes is similar to discharging into the dry bed of a stream which normally drains a much greater area.

Originally, the canning plant was located well outside the city, but now it is surrounded by many homes. A park and hospital are located on the small creek near the plant and below the point of mill waste discharge. About a mile downstream, there is a sewage treatment plant serving an area on the south side of town. These locations are shown in Fig. 1.

Plant Operations

The canning season is extensive because this plant is equipped to pack many different foods; such as white and sweet potatoes, sweet and pickled peaches, green beans, spinach, turnip greens, baked navy beans and pimentoes (its specialty). Peach canning, however, is the pack that causes the most trouble—it occurs during the summer, is generally very large, but is of short duration. Furthermore, the peaches are peeled with the use of lye, and the peach acid makes it necessary to renew the lye bath more frequently than is required for the lye peeling of white potatoes.

Peaches are received at the canning plant in boxes and must be handled carefully in order to prevent bruising. Only fruit that is firm (barely ripe) can be used for canning, overly ripe and bruised fruit must be discarded. The peach is cut and the pit removed before lye peeling the canning sections, though some whole fruit is pickled. Peach halves travel through the hot lye bath on a traveling screen. As peaches tumble from the screen they are partially washed in a small amount of water to remove excess lye, and then are thoroughly washed in rotary screens with a large volume of spray water. After leaving the rotary screen, each peach half is manually taken from one belt, inspected, trimmed and placed on another belt, from which it is taken to fill the cans.

The canning plant was operated for a number of years before this study of wastes was made. During some years, fish had been killed in the small pond shown in the map in Fig. 1. Several analytical studies of the canning wastes had been made during previous seasons but, in the spring of 1952, the Company employed the authors to determine how to can peaches without producing wastes which would kill fish.

Preliminary Investigation

Data from the investigations of previous years of operation was made available to us. The canning of white potatoes was in progress at the start of the study (April, 1952), and gave us a means of determining the extent of pollution from a lower waste load, at stream temperatures lower and at stream flow rates higher than exist during peach canning periods.

Following recommendations, based on available data, a lagoon was built on the canning plant property to retain the lye-peel tank liquor and first rinse. This lagoon was as large as the available property and was treated to control odors. Liquid wastes beyond the first rinse were collected in a large tank and pumped from this tank through two, 4-ft. dia. Sweco Vibrating Screens. For pimento, string bean and other vegetable wastes, a stainless steel wire cloth of 150 mesh is used. For peach canning the screens used

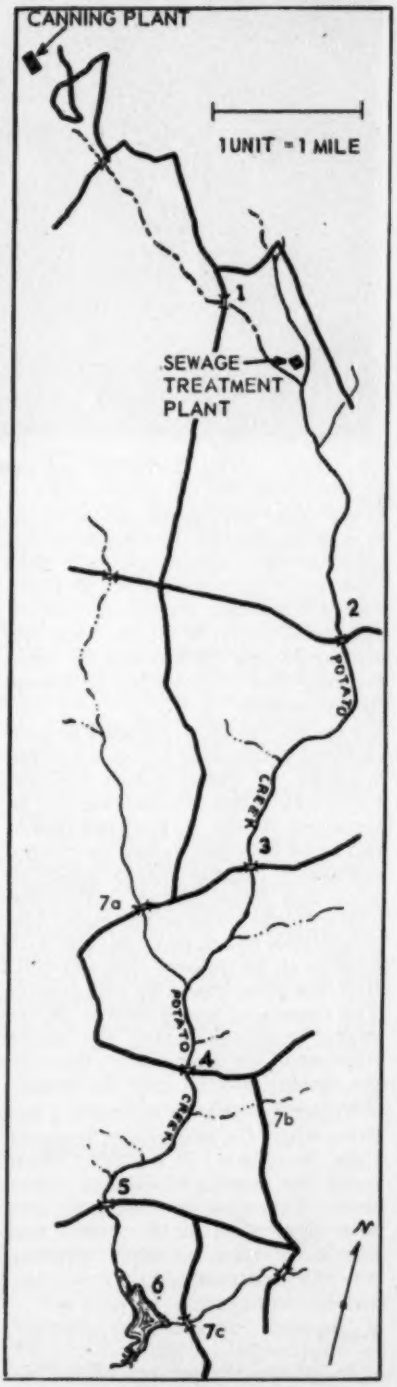


Fig. 1—MAP of Potato Creek and pond with sampling stations numbered

*Mr. Ingols is Research Prof., Eng. Expt. Station. Mr. Hogden, formerly research asst., is now with the Florida State Board of Health. Mr. Miller is Assoc. Prof., Public Health and Biology.

Fig. 2—SWECO and screenings storage hopper

in the study were 80 mesh (40 mesh is now employed). For Irish potato waste 20 mesh screens are used. The capacity of each screen is 450 gpm. Liquid from these screens discharged directly to the creek. Solids from the screens go into the elevated bin with dumping doors for loading haulaway trucks beneath.

For the study, observation and sampling points were set up at several locations on Potato Creek and its tributaries. These observation points are shown on Fig. 1. Frequent observations of the creek during the potato and peach canning season indicated color and foam, but no particulate matter in the water at any time. Approximately one to two cubic yards of solid peach debris were removed daily from the plant wastes by the screens. The absence of peach sections in the stream greatly improved the public relations of the company by removing the obvious material from the stream.

Figure 2 shows the screens in a position where the solid matter removed could be collected in a hopper which could be discharged into a dump truck. This position also made for easy observation of the screens and simple servicing although servicing was rarely necessary.

Results

In spite of the removal of the lye-peel tank liquor from the stream, and consequent reduction in load, the quality of the stream at points 3 and 4 deteriorated rapidly, to a condition of hydrogen sulfide production at Point 4, where the stream was a small pool six feet deep. Since sulfides were present, it was obvious that nitrate oxygen could be used by the stream bacteria. A ton of nitrate was dumped into the stream at Point 3 and brought a very marked improvement in the appearance in the stream although no dissolved oxygen could be found in the stream.

For the balance of the season, one-hundred pounds of sodium nitrate were added to the plant discharge with each hour of operation. This practice maintained the river in an odor free condition. Small amounts of nitrate have been added once a day, at other canning plants to accomplish the control of odor under similar conditions by utilizing the lag period in hydrogen sulfide production. At the Pomona plant, however, the nitrate was added in large amounts in order to supply oxygen to reduce the B.O.D. load upon the lake (Point 6) as well as to eliminate odors along the river course.

Two unusual conditions developed during the 1952 canning season, but in spite of these, no fish were killed. The peach crop developed very well in the Spring, but just as the peaches were approaching maturity, a drought developed and they failed to ripen within the short period of two or three weeks, usually experienced. The drought was also responsible for the minimum flow in the stream during the peach canning season. With the minimum flow in the stream, the wastes were detained for a longer period and thus the period of biological activity was prolonged, before the stream entered the pond. The drought also prolonged the canning season, which thus reduced the daily load upon the stream.

From only one season of study it was difficult to evaluate what factor was most important in the prevention of fish kill in the pond. It should be pointed out that the dissolved oxygen values dropped to the lowest values just after the lagoon began to overflow into the stream from the collection sump. Obviously, a larger lagoon was recommended for the next year.

Stream flow and the loading values in 1952 are shown in Fig. 3. The dissolved oxygen condition of the stream and lake is shown in Fig. 4. The bottom waters of the lake (2 feet below surface and lower) in all areas, other than that portion fed directly by an unpolluted stream, was devoid of dissolved oxygen for two weeks. As shown in Fig. 4, the surface of the lake showed low dissolved oxygen values, but at no place was it devoid of oxygen. Near the lake outfall, the surface D.O. approached normal (100 per cent saturation) values, but the deep water feeding a flour mill contained hydrogen sulfide after the end of the canning season. The importance of reaeration in maintaining dissolved oxygen at the lake surface is evident from the absence of a temperature gradient to explain low dissolved oxygen at the bottom and relatively high dissolved oxygen concentrations at the surface of the pond.

Before the 1953 canning season, the lake property and adjacent farm were sold at auction and purchased by the canning company. The company, therefore, is free of fear from suits for damages for killing fish in the pond. They did, however, operate the lagoon during the 1953 peach canning season and are interested in maintaining the pond for fish if it is possible.

General Observations

The death of fish in a stream or lake is apparently dependent upon several factors other than dissolved oxygen content alone. Small fish (minnows) were observed alive in a deep pool of the stream (at Point 4) even when there was an odor of hydrogen sulfide present. The fish all lived at the surface of the pool and continually broke the surface so that from a distance. it appeared to be raining on the water. Although the weather in Georgia brings ice formation, ice forms only

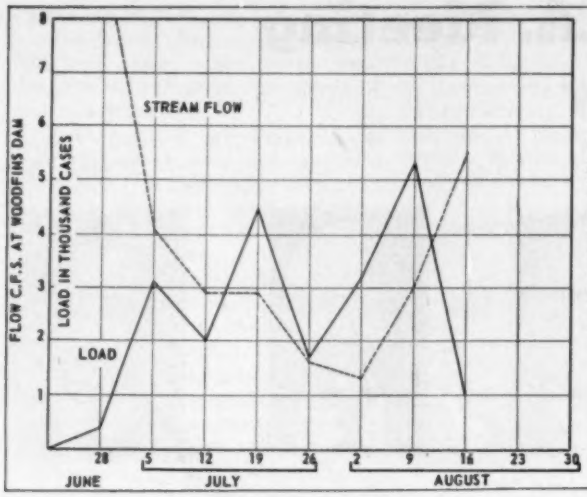


Fig. 3—LOAD and stream flow

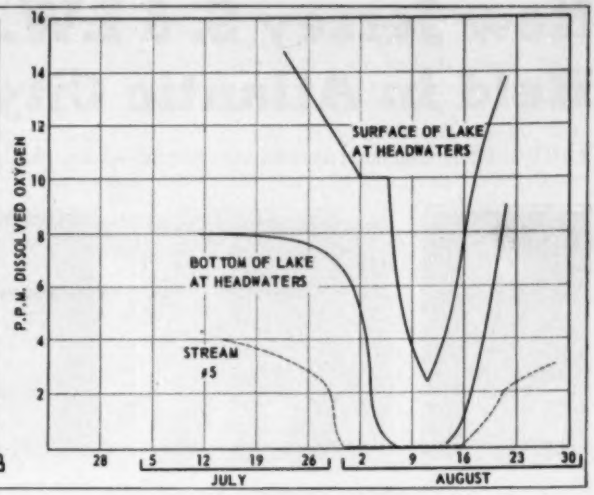


Fig. 4—D.O. CONDITION of stream and pond

very infrequently, but on the other hand, the temperature of the water at the water at the surface of the pond has been found at 40°C in shallow areas. This temperature is so close to the maximum value that most fish can tolerate, that it is not surprising that fish kills have occurred in past seasons, even with some dissolved oxygen probably present.

Observations of the microbiological forms were also made. The data presented in Table 1 show that marked changes occur in the number and identity of the microorganisms found. One sample had such a large number of protozoa that the sample resembled a well established hay infusion culture or trickling filter slime. When the heavy organic matter load was withdrawn the large number of microorganisms rapidly disappeared, but the large variety of the unpolluted condition of early Spring was slowly reestablished.

A "routine" periodic check of the lake during November, 1952, revealed that dissolved oxygen was practically absent in the water. Sweet potatoes were being canned and no precautions for controlling waste discharged was being practiced. The stream showed dissolved oxygen near the plant along with free starch. The water temperature of 11°C had delayed the oxygen demand from the stream to the lake. The low temperature, however, apparently controlled the rate of fish metabolism so that the very low dissolved oxygen values were not lethal. Because 11°C is about the lowest temperature noted in this pond during that winter season, it should not be inferred that fish elsewhere can live in the absence of D.O. and at 11°C.

Table 1
Summary of Biological Observations of the Number of Species of Microorganisms by Classes
Samples taken at Point No. 4 on Potato Creek

Phylum or Sub Phylum	Class of organism	Dates of Observation 4-25-52	11-5-52	11-12-52	1-15-53
Protozoa	Ciliata	3	2*	2*	1
	Sarcodina	1	—	1	—
	Mastigophora	1	1	2	1
Rotifera	Rotifers	3	2	0	2
Algae	Diatoms	10	3	2	3
	Blue Green	—	1	1	—
	Green	7	—	2	1
Fungi	Phycomycetes	—	2	1	1

*Present in tremendous numbers

Summary

The results in this study are reported for the purpose of demonstrating that nitrates can be used to relieve both odor and reduce B.O.D. in a flowing stream and thus allow dissolved oxygen to develop more rapidly downstream. It is realized that nitrates cannot prevent oxygen depletion, indeed cannot function without oxygen depletion, but they can serve to produce better downstream conditions while alleviating some of the objectionable features of a short period high pollution load typical of canning plants.

The Sweco Screen separators installed by Pomona Products Co. have removed the solids wastes and improved the appearance of the stream although the B.O.D. load has not been reduced appreciably. Two additional screen separators have been installed since this study.

The work reported in this study was sponsored by the Pomona Products Co. of Griffin, Ga.

Graduate Research Assistantships in Sanitary Engineering

The Department of Civil Engineering at the State College of Washington has available a number of Research Assistantships for students desiring to work toward the degree of Master of Science in Sanitary Engineering. These positions are provided by the Div. of Industrial Research and the Civil Engineering Dept. of the College. The assistantships involve half time service during the academic year of nine months and allow for the completion of the degree requirements in two academic years. The stipend is $1400 for the first year and $1490 for the second year.

In addition to the above, full time summer work will normally be available with the division of Industrial Research at a rate of approximately $310 per month. It is highly probable that a number of persons will be required during the summer of 1954 and preference will be given to those candidates who are accepted for graduate work starting in the fall.

For further information address inquiries to Professor Emmett B. Moore, Chairman, Department of Civil Engineering, State College of Washington, Pullman, Washington.

New Jersey S. & I.W.A. Meeting Held in Atlantic City

Thirty-ninth annual meeting attended by 450

Past Pres.
Sol Seid
Supv. Pub. Wks.
New Brunswick, N.J.

President
John Hood
Supt., Sewage Tr.
Ridgewood, N. J.

1st Vice-Pres.
John W. Collom
Supt., Sewage Tr.
Bordentown, N. J.

Officers of the New Jersey Association

2nd Vice-Pres.
Andrew Palmer
Supt., Jt. Mtng.
Dunellen, N. J.

Secy.-Treas.
M. S. Kachorsky
Supt., Pub. Wks.
Manville, N. J.

THE thirty-ninth annual meeting of the New Jersey Sewage and Industrial Wastes Assn. was held in Atlantic City on March 10-12, 1954. The total registration was 450. As usual, this meeting provided a full technical program and a variety of social events.

Regular features have come to include a luncheon, the annual "speechless" dinner and entertainment, and the operators' breakfast. For the ladies, there was a get-acquainted party and an annual dinner all their own.

Association Luncheon

Guest speaker at the Association luncheon was HON. EDWARD PATTON, Secretary of State of New Jersey. He named the treatment of sewage and industrial wastes, together with water supply, as important factors contributing to the development of communities and of the State.

L. J. FONTENELLI, F.S. & I.W.A. president, and Supervising Engineer, Rahway Valley Sewerage Authority, brought a message from the national association.

Business Meeting

The Operators' Breakfast and Business Meeting were a feature of the last day of the meeting.

Sol Seid, retiring president, was named chairman of the Arrangements Committee for the Federation's 1955 meeting. The New Jersey association will hold its annual meeting concurrently.

John W. Hood was officially installed as the new president of the N.J.S. & I.W.A. for a two-year term.

John Collom was elected first vice-president, and Andrew Palmer was elected second vice president.

Technical Program

Operation by Instruments

"INSTRUMENTATION FOR SEWAGE PLANT OPERATION," Edw. R. Grich, Instructor in Sanitary Chemistry, Manhattan College, N.Y., N.Y.

Instrumentation in the laboratory improves the accuracy and reproductibility of analytical procedures. Instruments now available may be used to perform analyses which formerly were deemed impossible or impractical.

In addition to determining hydrogen-ion concentration, the pH meter may be used to measure the oxidation-reduction potential of sewage. All that is required is the substitution of a platinum electrode for the glass electrode normally used. Changes in the oxidation-reduction potential of sewage may be governed by oxygen supply, food supply, bacterial density and other factors.

Photometry involves illumination of a colored sample with white light, part of which is absorbed and the remainder transmitted. Standard solutions are used to prepare reference curves to which per cent transmittancies from unknown sewage samples may be compared. Among the constituents of sewage which may be determined by photometry are: copper, chromium, ammonia, nitrate and nitrites. It has also been shown that a correlation exists between B.O.D. and the per cent transmittancy of a sewage sample.

The polarograph may be used in analyzing for dissolved oxygen, oxygen utilization and the presence and concentration of metallic ions in a sewage or waste. This instrument employs a dropping mercury electrode, a calomel reference electrode and a galvanometer to indicate the current flow resulting from voltage applied to a sample.

Slides were used to illustrate working models of each of the instruments described.

MR. HEDGEPETH, in the discussion which followed, expressed interest in the correlation between sewage B.O.D. values and light transmittancy. He commented that such procedures should be studied with a view toward inclusion in "Standard Methods," since these are tantamount to legality.

New Primary Plant

"THE NEW LINDEN-ROSELLE SEWAGE TREATMENT PLANT" was described in a paper presented by

New Officers

President
John Hood
Supt. of Sewage Tr.
Ridgewood, N.J.

First Vice-Pres.
John Collom
Supt. of Sewage Tr.
Bordentown, N.J.

Second Vice-Pres.
Andrew Palmer
Supt., Plainfield Jt. Mtg.
Dunellen, N.J.

Secretary-Treasurer
M. S. Kachorsky
Supt., Pub. Works
Manville, N.J.

Federation Representative
H. Van Der Vleit
Supt., Joint Meeting
Carlstedt, N.J.

CHARLES SAUNDERS, Asst. Supt., The Linden-Roselle Sewerage Authority. Excellent color slides were used throughout to illustrate the details of this new plant.

In preparation for construction, eight gauging stations were operated and a survey of local industrial wastes was made. Because a number of highly toxic wastes were discharged, consideration was given to adoption of treatment other than biological processes. The Arthur Kill, leading to salt water, provided substantial dilution for the 12.5 mgd to be treated.

A 5,000 cfm ventilated force main brings sewage to the new treatment plant. The first treatment units are mechanically cleaned screens, from which screenings are mechanically removed, macerated, and returned to the flow. These are followed by four centrifugal lift pumps of varying head capacity (14-in., 16-in., and two 18-in.), together totalling 37.5 mgd delivery and operated by sequence switches (automatically controlled in nine steps).

Following grit removal, the flow is measured by a Venturi meter and is registered on receivers in both the administration building and the pumping station. Three circular clarifiers (106-ft. diameter) provide four hours detention at average 12.5 mgd flow. The sludge is discharged to storage and concentration tanks, thickened to 7-10 per cent solids, and pumped to barges for ocean disposal. The barges dump sludge 12 to 15 miles off shore, but to do so must travel 50 miles.

The joint plant (costing approx. $4 million) is financed by 25-yr. bonds, and is operated under authority management. Sludge barging costs $.64 per ton (the same barge serves other communities). Disinfection may eventually be required, and room for this equipment is provided in the new plant.

Equipment and "Livestock" for Biological Waste Treatment

"DESIGN AND OPERATION OF EXPERIMENTAL EQUIPMENT FOR BIOLOGICAL TREATMENT OF COMPLEX ORGANIC CHEMICAL WASTES" was the title of a well-organized panel discussion moderated by L. L. HEDGEPETH, Tech. Consultant, Amer. Cyanamid Co., Bound Brook, N.J.

The four panel members were: John Vogler, San. Engr.; George Hendee, Project Engr.; Alfred Cherry, Asst. San. Engr.; and Louis Tucci, San. Engr. All are employed by the Amer. Cyanamid Co. at Bound Brook, N.J., with the exception of Mr. Cherry who is from the company's Lederle Laboratory Div., Pearl River, N.Y.

MR. VOGLER led off the discussion by emphasizing the necessity for careful preliminary investigations to determine if biological oxidation of specific wastes is practicable. Generally this is best done by making laboratory studies and, if laboratory results are encouraging, by constructing and operating pilot plants based on the laboratory results. Precise information on "how much?" can be obtained from pilot plant treatment; further, the information gained generally saves money later. It may be necessary to utilize a second, and larger, pilot plant to provide essential data.

MR. HENDEE related his discussion to pilot plant design problems. He advocated the use of conventional equipment (ready-made units) in order to better extend the results to larger units. The design engineer has an important part in evaluating the economics of treatment processes. In a pilot plant, flexibility should be the keynote; a minimum of automatic control equipment should be included; and pilot plants are best operated under a time limit.

MR. CHERRY reviewed the operating problems of pilot plants, emphasizing the prime necessity of obtaining reliable data. In the pilot plant study described, observation of an operating filter showed that a prolific growth of iron bacteria would occur —valuable information in full scale filter design. Data on C.O.D. vs. B.O.D. values, and on special tests and biological examinations may be very useful. The data obtained are only as good as the samples obtained (hourly samples were taken at one plant, and 30-min. samples at another). One month should be the minimum operating time before any new conditions are introduced.

MR. TUCCI, in describing "the livestock" in a biological waste treatment plant, said that a good biota does not just happen. The main difference between treatment of industrial waste and sewage is one of composition. Nature has provided a good—and readily available—working force to dispose of sewage, but industrial wastes are rare in Nature. Man's trickling filter must depend upon filter slime, a synergistic community of microorganisms; if this is not well-balanced, waste treatment will go only so far and no farther. Consistent agreement has been found, in the Bound Brook studies, between laboratory tests and pilot plant results. Engineering is not complete, said Mr. Tucci, unless the entire field of biology is considered in devising treatment methods.

Each speaker on the panel illustrated his discussion with lantern slides showing units in design and operating stages.

Chairman and Members of the Program Committee

A. H. Fletcher, Dir. Env. San. Bur., St. Health Dept., Trenton, N. J.
L. L. Hedgepeth, Tech. Consultant, Amer. Cyanamid Co., Bound Brook, N. J.
R. S. Shaw, Acting Chief Engr., St. Health Dept., Trenton, N. J.
F. E. Reimers, Chem. Engr., Merck & Co., Berkeley Ht., N. J.

F.S. & I.W.A. Officials

Assn. Repres. Henry Van Der Vleit, Superintendent, Jt. Meeting Tr. Plant, Carlstadt, N. J.
Assn. President L. J. Fontenelli, Supv. Engr., Rahway Valley Jt. Mtng., Garwood, N. J.

An Industrial Waste Program*

"INDUSTRIAL WASTES IN MUNICIPAL SEWERS—FLEXIBLE OR STRICT REGULATIONS?" This question was answered by DR. H. HEUKELEKIAN, Professor and Research Specialist in Sanitation, Rutgers Univ., New Brunswick, N.J. DR. H. E. ORFORD, Acting Chief, Dept. of Sanitation.

*This and the following technical papers were reported by V. W. Langworthy, Research Chemist, The Chlorine Institute, Inc., New York.

H. Heukelekian
Prof. of Res. Eng.
Rutgers Univ.
New Brunswick, N. J.

H. Orford
Acting Chief of San.
Rutgers Univ.
New Brunswick, N. J.

R. W. Haywood
Eng. Serv. Div.
E. I. du Pont Co.
Wilmington, Del.

F. L. Sommer
Sales Engr.
Simplex Valve Co.
Philadelphia, Pa.

Programmers

Rutgers Univ., was co-author of the paper which outlined the difficulties faced when a model ordinance is drawn up. It was pointed out that each situation is different, requiring flexible rules and regulations.

The authors consider that a treatment agency should accept all liquid wastes within a sewage-shed, because the concurrent treatment of sewage and industrial wastes is more economical than separate treatment. Supervision and control are maintained more easily at one central location, and industry is relieved of waste treatment responsibility. What is needed are guiding concepts for controlling discharge into public sewers.

The authors prescribed a set of minimum regulations which, supplemented by flexible guides, provide a practical approach to sewer system operation. Restrictions should be placed on wastes discharged, limiting storm water, solid materials, oils, inflammable materials, toxic and obnoxious substances.

Such a program might be implemented by requiring industry to register and reveal the specific wastes resulting from industrial processes. Permits with rights of revocation, and penalties for infractions, would insure compliance with regulations. Rights of entry and the levying of special charges are additional factors which should be available to the agency responsible for wastes treatment.

A flexible program for the control of industrial wastes in municipal sewers should be based on the collection of adequate information. A simple application form will suffice, except for industries having complex problems.

Mr. L. H. Enslow, Editor, *Water and Sewage Works,* pointed out in discussion that the problem of industrial growth often taxed a community's sewerage system. It therefore appeared that the flexibility of regulations, and the ability to enforce them, are all-important. Dr. Orford answered that new challenges should be re-evaluated as they occur.

Cost of Sewage Disposal

"Cost Studies of Sewage Disposal Systems," a paper by Mr. J. W. Zelley, Sr. Public Health Engr., N.J. Dept. of Health, and Mr. M. S. Kachorsky, Borough Engr., Manville, N.J., discussed methods of financing sewage disposal facilities in New Jersey.

Mr. Kachorsky, Secy. of the New Jersey Sewage and Industrial Wastes Assn., pointed out that the methods include: financing by current income, cash reserves, general obligation bonds, revenue bonds, public utilities, sewerage authorities and private utilities. It was emphasized that sufficient revenue must be realized to meet operating expenses and to provide working funds.

New Waste Treatment Unit

"Organic Wastes Treatment in a Suspended Solids Reactor," by G. A. Olson and R. W. Haywood, Jr., Eng. Dept., E. I. du Pont de Nemours and Co., Wilmington, Del., reported on a study of wastes resulting from the manufacture of photographic film.

Mr. Haywood presented the paper and described the operation of a pilot-size sludge contact reactor treating wastes containing methanol, ethanol, acetone, acetic acid, gelatin, diacetone, and silver salts. Waste volumes total approximately 1.6 mgd during winter months, and up to 2.5 mgd in the summer. The waste contains 79 ppm. B.O.D. is low in suspended solids, and is free of color.

Laboratory studies revealed that biological treatment would reduce the B.O.D. in a contact reactor, if air were supplied to promote biological life. Operating experience shows close control to be necessary if sludge bulking, floc carryover, and foaming are to be avoided. Critical factors are reported to be: pH value, temperature, and concentration of influent B.O.D. (efficiency is highest at low B.O.D. values). Air requirements (2-4 cu ft/gal) for the process are approximately four times greater than for domestic sewage treated by the activated sludge process. Overall treatment costs are estimated to be $30-$40 per day, per pound of B.O.D. removed. Slides were used to illustrate flow diagrams of the treatment process and the B.O.D. reductions obtained.

Replying to a question by Mr. Hedgepeth, American Cyanamid Co., Mr. Haywood indicated that trickling filters in large sizes would provide an equivalent degree of B.O.D. removal.

Concrete Pipe Improvements

"The Trend in Quality and Joints for Reinforced Concrete Sewer Pipe" was the title of a paper presented by Hugh Kennison, Chief Engr., Lock Joint Pipe Co.

Improvements in sealing joints of sewer pipes have resulted from using rubber gaskets instead of mortar joints. This is significant, because the growing per capita use of water dictates exclusion of as much ground water as possible. For utmost effectiveness, rubber seals must fit closely, and installations must be carefully inspected.

Flotation tendencies in sub-aqueous sewer outfalls are being overcome through the use of pipe having a 14-in. wall thickness (in the past, 8-in. walls have been generally use).

Advancements in techniques for the manufacture of reinforced concrete pipe were described, and the roller-suspension method was illustrated by Mr. Kennison with lantern slides.

Good Maintenance Practice

"Maintenance of Metering and Control Equipment" was the topic of a paper by F. L. Sommer, Dist. Mgr., Simplex Valve and Meter Co.

Instruments usually installed for the measurement of raw and treated sewage, or for various in-plant purposes are of two general types: those measuring flows under pressure and those measuring flows in open channels or partially full pipe. It was recommended that piezometers be cleaned regularly and all piping be kept free of solids. Regular inspections of all metering equipment is the basis for a good maintenance program.

Mr. Sommer suggested several diagnostic procedures which would enable operators to solve some difficulties without calling a service man. Among the maintenance jobs which may easily be done locally are mercury weighing, air purging, oiling and cal-

ibration, using the manometer check apparatus supplied by the manufacturer.

Treating Milk Wastes

"TREATMENT OF MILK RECEIVING PLANT WASTES," was the title of a paper by A. J. POWERS, Director of Quality Control, and S. TRANI, Chemist, Borden's Farm Products Division, New York Fluid District.

In this paper, Mr. Powers pointed out that numerous stations located in the vicinity of dairy farms receive milk in ten-gallon cans. Waste from these stations usually goes to a nearby stream. Chief source of waste is from milk-dumping and can washing operations. Drippings may total 4 ounces of milk per can. Some waste reduction has been effected by trapping can drippings for resale as stock feed to farmers. Bulk water waste is controlled by automatic shut-off nozzles on hose lines, and by training all employees to be waste-conscious.

Operation of treatment facilities at the Blairstown, N.J., receiving station were illustrated with slides showing can washing apparatus, and waste treatment by sedimentation and chlorination.

A Record of Residual Chlorine

"RECORDING OF RESIDUAL CHLORINE IN SEWAGE TREATMENT" was the title of a paper "designed to remove the mystery from the W&T residual chlorine recorder." A. E. GRIFFIN, director, Technical Service Dept., Wallace & Tiernan, Inc., Newark, N. J. emphasized that bacteriological results dictate the magnitude of residual chlorine to be maintained in a sewage treatment plant effluent.

The W & T residual chlorine recorder generates an electrical current when a liquid containing chlorine passes through a sensitive cell. The current is amplified and used to operate an indicating pen. The unit requires a clear sample, to prevent clogging, and a constant 300 gpm flow over the electrode. Electrode poisoning is prevented by moving grit particles which polish the exposed platinum surface.

Determination of residual chlorine in the recorder is based on the principle of the release of iodine from potassium iodide when chlorine is present. The sample is buffered to pH 4.0 ahead of the cell, where an excess of KI is added. The iodine thus released is titrated with phenylarseneoxide, during which time a minute electric current is generated and transmitted to the pen for chart recording.

Programmers

A. E. Griffin
Dir. of Tech. Serv.
Wallace & Tiernan
Pompton Plains, N. J.

P. N. Daniels
San. Engr.
City of Trenton
Trenton, N. J.

E. I. Merrill
Plant Engr.
Johns-Manville Corp.
Manville, N. J.

Wm. Eigenraugh
Operator
Sewage Tr. Plant
East Rutherford, N. J.

"REDUCTION OF PAPER MILL POLLUTION THROUGH RECIRCULATION," was described by E. I. MERRILL, Plant Engr., Johns-Manville Corp., Manville, N. J. A reduction of pollution was accomplished by re-use of water in a plant manufacturing roofing felt from wood pulp and waste paper. Recirculation practices enabled the waste to be reduced from 800 gpm to 30 gpm. Two surge tanks facilitate return of water to the papermaking process.

Slides illustrated papermaking equipment and water flow from paper machine cylinders through the recirculation system. The process has provided a 68 per cent reduction in B.O.D. discharged to the Raritan river, 39 per cent savings in process materials, 86 per cent savings in fuel consumption, and 96 per cent reduction in water requirements. A quality problem was introduced, due to increased inflammability of the finished paper, caused by concentration of natural resins in the water.

Discussion revealed that no slime problems have been experienced, but surge tanks cleaning is required periodically and some odor occurs at that time.

Treatment Symposium

"HEADACHES IN SEWAGE TREATMENT," was the title of a symposium moderated by P. N. DANIELS, San. Engr., Trenton, N. J.

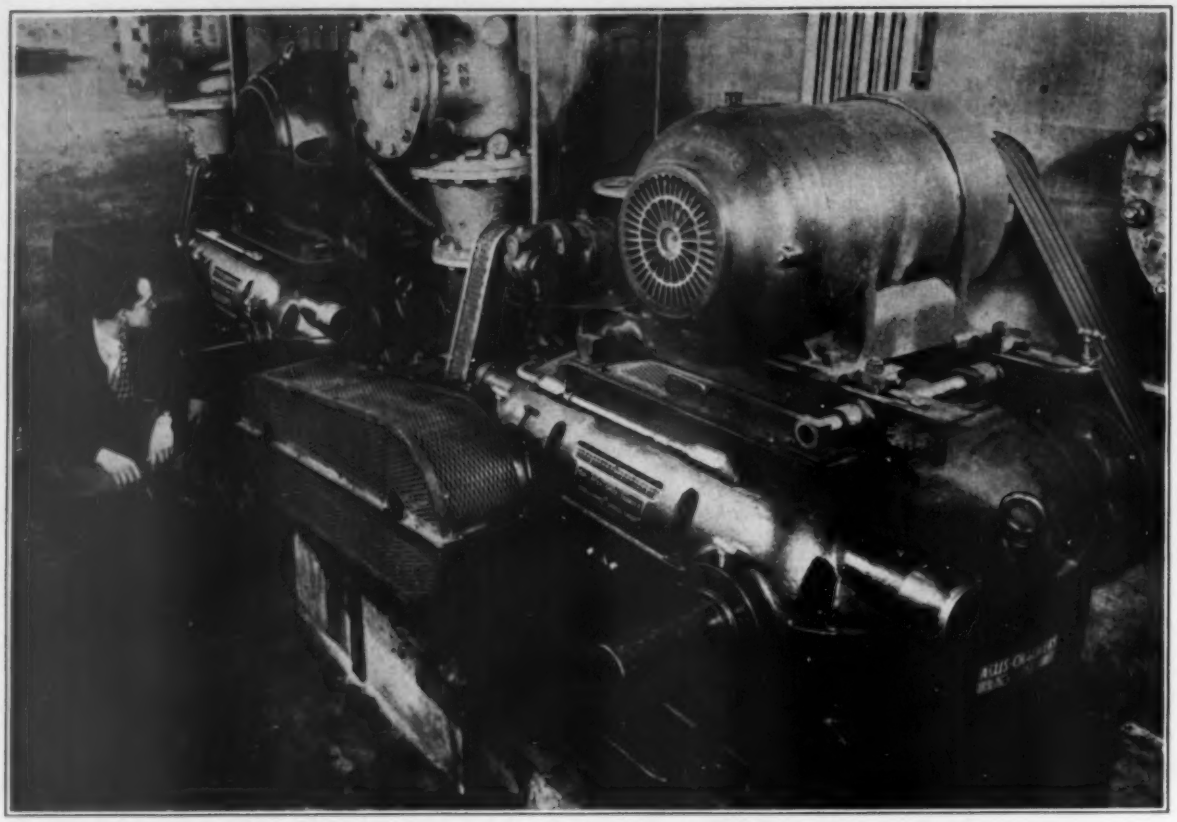
ANDREW PALMER, the first speaker, described operations at the Plainfield Joint Meeting Plant, Dunellen, N. J. His main "headache" has resulted from grit accumulation in digesters, and he suggested consideration be given to use of heavier gauge metal and protective coatings in digester covers. On the basis of his experience with digesters, it was recommended that new digesters be equipped with an opening near the bottom for entry and repair purposes. More frequent visits by representatives of the State Health Dept. would be helpful to plant operators.

RAY CASE, Supt., Merchantville, N. J. indicated some sludge handling "headaches" could be avoided with properly designed grit chambers. He also commented on flooding of plants by high tides; the lack of cooperation by local governing officials; and odor complaints when odors actually were caused by nearby industries.

C. C. CORNELIUS, Supt., Sea Girt, N. J. gets his "headaches" when seeking money for repairs and maintenance. Standby emergency equipment is lacking at his plant—which forces shutdown of all pumps and other equipment when ocean storms cause power failures.

J. L. PURCELL, Supervisor Bendix Aviation Corp., pointed out that his remarks applied only to the Teterboro, N. J., treatment plant of Bendix Aviation Corporation. Considerable difficulty has been experienced with raw sewage pump shaft and bearing failures due to excessive vibration. Plant improvements during World War II included the construction of new pumping station which provided a separate wet well, permitting pump repairs to be made without the men working in raw sewage. Odors from Imhoff tank scum are solved by keeping scum submerged or by removing accumulations for burial. The plant effluent receives final treatment by sand filtration and chlorination.

F. B. MASON, Supt. of Sewers, New Providence, N. J., pointed out that progress in equipment design causes many units to become obsolete after ten or twelve years. His particular concern is with thermal cut-out devices for electrical switch-gear. Switches are inoperable without these protective accessories which are no longer available. The problem has been solved at considerable cost by providing external cut-outs which are wired into the older switches. Industrial wastes containing cyanides and suspended solids from a rubber tire reclaiming plant cause operating difficulties at his plant. The new plant does not have a grit chamber, which complicates sludge handling.



VARI-PITCH speed changers effect automatic pumping control at Milwaukee's Sewage Treatment Plant.

Consider Variable Speed Drive

For Water and Sewage Treatment Plants

by **F. H. RUMBLE,** *Engr. Allis-Chalmers Mfg. Co.,* Milwaukee, Wis.*

FOR those interested in increasing the versatility or flexability of the machines in their plants, adaptation of the variable speed V-belt drive may well be the answer. In general, the *variable speed* drive is practical wherever a *constant speed* V-belt drive can be applied. And a variable speed drive can often be installed on existing pumps or other machinery to make possible an improved operation performance or effect economies, or both.

Six or seven points should be taken into consideration to determine whether or not a variable speed drive can be used and if it can, which type is the most practical.

The factors involved include the type of operation, type of driven machine, speed range required, horsepower of motor, when speed change is needed (when drive is in motion or stationary), the type of control needed, and the type and speed of motor.

Let us consider these factors in the light of an installation using an exhaust fan to draw fumes from a room. The speed range in this particular instance is from 475 to 575 rpm. The motor is a standard 15-horsepower, 1,800-rpm unit. Change in speed is needed only infrequently and the drive may be stopped while the change is being made.

In the light of these conditions, a standard range, stationary control, variable diameter sheave fills all requirements in a variable speed drive for this application. Then, by consulting the manufacturer's pre-engineered drive tables, it is possible to determine the particular size standard range drive to fit all other requirements in the installation just stated.

There is available to the plant managers and engineers a variety of types of variable speed drives and wisdom dictates that he select the one best fitted to fill all his needs at the lowest cost.

The accompanying chart lists six types of variable speed drives of the "Texrope" type with speed range, horsepower capacity, size, type and method of speed change of each, classified with typical applications.

The photograph used with this article pictures an installation at the Milwaukee Sewage Treatment Plant of three vari-pitch speed changers installed to provide the wide range of

*TEXROPE Drive Dept.

SIX TYPES OF "TEXROPE" VARIABLE SPEED DRIVES

Type	Speed Range	H.P.	Belt	Sizes and Grooves	Typical Applications
Adjustable Sheave (Adjustable while drive is stationary)	Up to 50% Speed Increase	Fractional to 4 hp	Standard A or B Section	10 Sizes; 1 or 2 Grooves	Light drives; small pumps; blowers; fans; stokers; lathes; saws; tools and appliances.
Standard Range Stationary Control VARI-PITCH Sheave (Adjust while drive is stationary)	Up to 28% Speed Increase	1 to 300 hp	Standard A, B, C, D, or E Section	22 Sizes; 2 to 12 Grooves	Pumps, blowers, fans; spinning frames, yarn covering machines; canning machines, crushers, hammermills.
Standard Range Motion Control VARI-PITCH Sheave (Adjustable while drive is in motion)	Up to 28% Speed Increase	1 to 300 hp	Standard A, B, C, D, or E Section	21 Sizes; 2 to 12 Grooves	Pumps (liquid and sludge handling); fans, blowers, circulating pumps, lathes, grinders, drills, paper-making machines.
Wide Range Stationary Control VARI-PITCH Sheave (Adjust while drive is stationary)	Up to 100% Speed Increase	1 to 60 hp	Wide Range Belts Q or R Section	6 Sizes; 1 to 4 Grooves	Spinning frames, twisters, bottle washers, conveyors, generators, machine tools, assembly line equipment.
Wide Range Automatic VARI-PITCH Sheave (Adjustable while drive is in motion)	Up to 100% Speed Increase	1 to 60 hp	Wide Range Belts Q or R Section	5 Sizes; 2 to 4 Grooves	Sewage, water and industrial waste equipment, pipe threaders, turret lathes, pea viners, grain dryers, spinning frames, solids handling pumps, testing machines.
VARI-PITCH Speed Changer (Adjustable while drive is in motion)	Up to 375% Speed Increase	1 to 75 hp	Wide Range Belts Q, R, S, or T Sections	12 Sizes; 1 to 5 Grooves	Sewage, water and industrial waste equipment, machine tools, testing machinery, conveyors, winding operation, pulverators.

pump speeds required to automatically maintain a constant level in some of the treatment tanks. Speed change is effected automatically through hydraulic float valves. The installation is similar to many similar installations in water purification plants when constant heads or uniform flows are required to facilitate treatment.

Harold T. Rudgal Succumbs to Heart Attack

Vice-Pres. and Gen'l. Mgr. of Gary-Hobart Water Co. was Formerly Supt. of Water and Sewage at Kenosha, Wis.

Harold T. Rudgal, dynamic and capable water utility executive succumbed to a heart attack in Philadelphia, Pa., on February 25. He was only 50 years old. His passing put a sudden end to a brilliant and productive career which took him from superintendent of sewage treatment at Kenosha, Wisc., to superintendent of water and sewerage at Kenosha and therefrom to the head of the Gary-Hobart Water Co. of Gary, Ind., as Exec. Vice-President and General Manager in March, 1951.

Death came to Rudgal while visiting at the Philadelphia home of his new bride. Within two months more he would have started in operation the new 48 mgd. filtration plant of the Gary-Hobart Water Co.—next to his new wife, his "first love."

A native of Philadelphia, Rudgal received the degree of Municipal Engineer from Drexel Institute of Technology in 1925 and joined the staff of Alvord, Burdick & Howson, Chicago consulting engineers. He resigned in 1940 to accept the position of superintendent of Kenosha's new sewage treatment plant. Seven years later he was made superintendent of water and sewage works at Kenosha, from which he resigned in 1951 to accept appointment as Vice-President and General Manager of the Gary-Hobart Water Co. of which W. Victor Weir of St. Louis is president and C. S. Mott of Michigan is owner.

Rudgal, the self-starter that he was, was active in the Wisconsin section of the American Water Works Assn. and since 1951 in the Indiana section. He was a past-president of the Central States Sewage Works Assn., and member of the Wisconsin Society of Professional Engrs. In community activities Rodgal was a Rotarian and a member of the executive board of the Gary Chamber of Commerce. He headed the Chamber's Committee on Health and Welfare. He was assistant secretary of the Gary Industrial Foundation.

Rudgal's diversions were golf and photography. For his photographs he had received prizes. Another distinction—a grandfather before the age of 50. With it all, "Ted" Rudgal was a first class citizen and individual, which the water works industry could ill afford to lose.

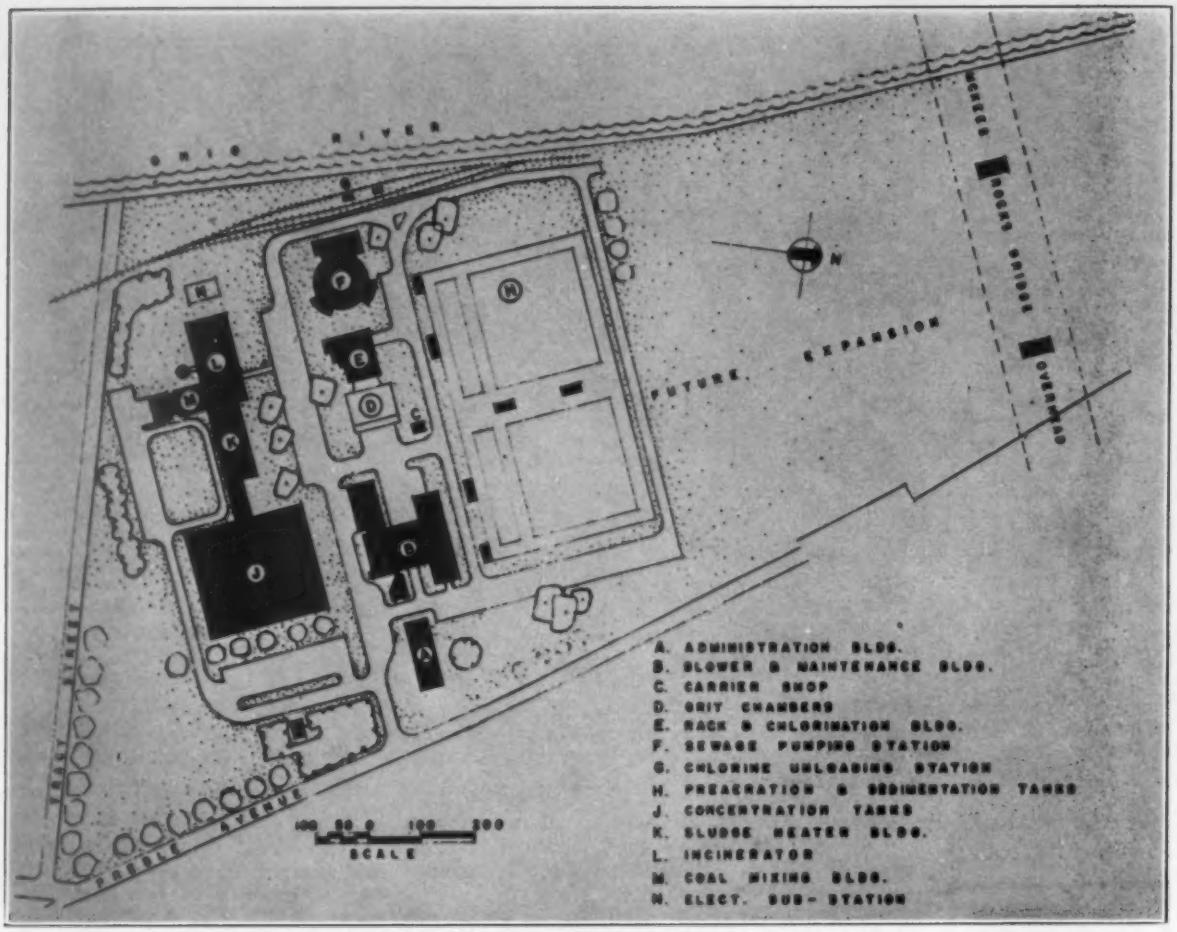
New Indianapolis Facilities to Cost $4 Million

During 1954, the Indianapolis Water Company plans on an outlay of $4,000,000 or more for various facilities to keep up with the growing demand for water.

The Morse Reservoir expansion will go well over $2,000,000 to provide a great new storage lake northwest of Noblesville. The White River purification plant will get at least $75,000 and the Fall Creek plant $18,000.

A $75,000 sum is included for planning the company's new general office, engineering and distribution headquarters building at Riverside Station. Riverside Pumping Station is earmarked for $40,000 of work in '54.

More than $1,250,000 will go for main extensions of all kinds; booster pumping stations will get another $45,000 and miscellaneous equipment, such as meters, taps, valves and tools, will require $350,000.



LOCATION PLAN of the plant identifies buildings and treatment units

Pittsburgh's Treatment

by **JOHN F. LABOON**, *Chairman of the Board and Chief Engineer, Allegheny County Sanitary Authority, Pittsburgh, Pa.*

AFTER more than 40 years of studies and reports, Pittsburgh and 63 of its suburbs have finally agreed on a plan for abatement of stream pollution.

The present Pittsburgh project is designed to serve 64 municipalities, including the City of Pittsburgh, for an estimated connected population of 1,400,000 in 1970 and 1,650,000 in the year 2000. The population equivalent load (including industrial sewage) in 1970 is estimated at 1,900,000.

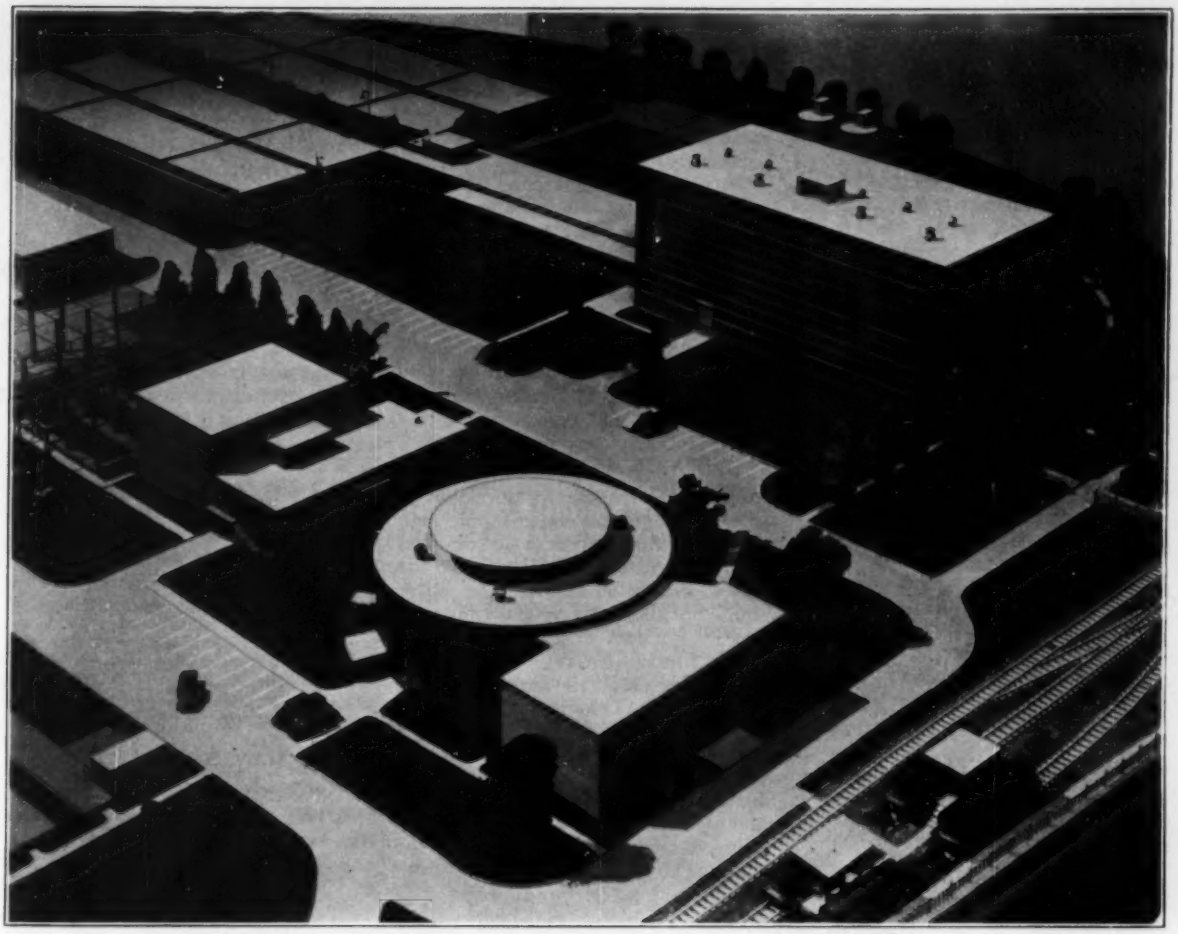
Under the adopted project, long-term agreements based on the issue of 40-year revenue bonds supported by sewage charges have been executed between the Sanitary Authority, the City of Pittsburgh, and the other 63 participating municipalities. Plans and specifications are practically completed and the project will be ready for construction in the spring of 1954.

Financing and Costs

Under the agreements, the City of Pittsburgh reserves the right to select a sewage agency other than the Sanitary Authority to issue bonds and carry on the construction. The estimated cost of the project, not including administration, engineering, land, rights-of-way, and interest during construction, is $67,000,000 at July 1953 prices. To cover all these items, the revenue bond issue would need to be $85,000,000. A pay-as-you-go plan recommended in the Sanitary Authority report of January 1948, to finance such expenses as the cost of engineering and interest during construction by partial sewage charges, was rejected by the City Council of Pittsburgh.

Plant Designed for 150 mgd

The adopted project consists of a 150-mgd sewage treatment plant providing for 50 per cent removal of biochemical oxygen demand and 63.5



MODEL of the Pittsburgh sewage treatment plant designed to treat a flow of 150 mgd

Plant Commended for Design

The Art Commission of the City of Pittsburgh recently awarded special commendation to the Allegheny County Sanitary Authority for the quality of the architectural design of Pittsburgh's new sewage treatment plant

miles of intercepting sewer, of which 32 miles will be in deep tunnel. Six minor sewage pumping or ejector stations will serve branch interceptors. The intercepting sewer system, 59 miles long, will conduct the flow by gravity to a central pumping station at the treatment plant site.

The special feature of the pumping station is the wet well, which is a circular concrete structure 40 ft. in diameter by 118.5 ft. deep, located in the center of the circular pumping-station pit so as to permit short suction lines and a most economical construction arrangement.

Six 60-mgd vertical pumps, automatically controlled by the level in the wet well, will be located in the pump pit, but only five will be installed initially. Of these, three will be two-speed with synchronous motors, and two will be variable-speed with magnetic motors.

Primary Treatment Provided

The treatment plant consists of screens and grinders, aerated grit chambers, preaeration and sedimentation tanks, blower plant, sludge concentration tanks, incineration, pre- and post-chlorination, and an administration building. This will produce the 50-per cent removal of the B.O.D. required for the present by the State Department of Health and the Ohio River Valley Water Sanitation Commission.

The treatment plant is designed for a capacity of 150 mgd, representing 1970 requirements. The ultimate capacity for the year 2000 is estimated at 175 mgd. Conduits and channels are designed for a peak flow of 300 mgd, estimated for the year 2000.

Space has been provided for future secondary treatment.

Raw Sludge to Be Concentrated

The most unusual feature of the treatment plant is the method of sludge disposal. This method, developed in the Authority's laboratories and pilot plant, is believed to be unique. Raw sludge will be concentrated for 5 days and then incinerated.

Laboratory and pilot plant experiments over a period of three years have demonstrated that raw sludge, preheated to 95 deg F and stored for a period of 3 to 5 days, will produce a concentration averaging 18 per cent total solids by flotation.

The design provides for a battery of 10 concentration tanks, one-half of one tank to be used as a raw-sludge compensating tank to serve the preheaters.

As previously mentioned, the concentrated sludge will be disposed of by incineration. The average volume is estimated to be 144,000 gpd and the maximum 270,000 gpd. Its moisture content is estimated to vary from 76 to 84 per cent. Bids will be taken on two alternate designs. One is based on the use of multi-hearth incinerators, the other on flash-drying incinerators.

Planning and Construction

Metcalf & Eddy, consulting engineers of Boston, Mass., are designing the sewage treatment plant and the Chartiers Creek and Turtle Creek intercepting sewers, estimated to cost $27,000,000 at July 1953 prices.

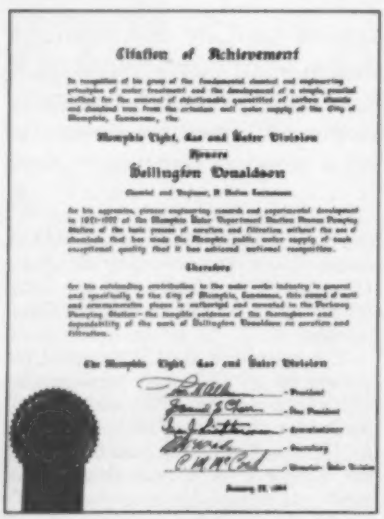
The Sanitary Authority staff is designing the major part of the intercepting sewers, estimated to cost $40,000,000.

Celli-Flynn, architects and engineers of McKeesport, Pa., are the consultants on design of all superstructures, interiors, and landscaping of the treatment plant and pumping stations.

Wellington Donaldson Honored by Memphis Water Division

Wellington ("The Duke") Donaldson, now deputy director of N.Y. City's Division of Sewage Disposal, has been voted a special "Citation of Achievement" by the Light, Gas and Water Division of Memphis, Tenn., in recognition of his work of 33 years ago in developing an economical, practical and time proven method of iron and carbon-dioxide removal from the well supply of Memphis.

It was the original investigations and pilot plant studies by Donaldson in 1921-1922 that made it feasible for Memphis to expand its development of artesian ground water supply and, thereby, avoid recourse to the less desirable Mississippi River in the needed expansion of Memphis' water supply. Donaldson at the time was Chief Chemical Engineer of Fuller & McClintock, Engrs., of New York City, who designed and supervised construction of Memphis' Iron Removal and Filtration Plant, operated without the addition of chemicals and relying on coke-contact tray aerators for carbon-dioxide removal, oxidation and flocculation of nature's contributed natural iron content of the well water. The result has been a low mineral, non-corrosive, pleasant tasting and remarkably brilliant water in copious quantities. After 33 years the methods and design of Donaldson and his firm in 1921-1922 are being duplicated in the recent plant expansions engineered by Black & Veitch of Kansas City after a study which confirmed the methods developed by Donaldson, while also permitting certain refinements in design made possible by the availability of modern materials of construction.



Citation of Achievement

Memphis Light, Gas and Water Division

Presents

Wellington Donaldson

The Memphis Light, Gas and Water Division

The citation, in the form of a scroll here pictured, is to be reproduced on a bronze plaque for mounting in the new Parkway Pumping Station and Purification Plant of Memphis. The citation reads—

"To Wellington Donaldson, chemist and engineer, and a native Tennesseean, for his aggressive and pioneer engineering research and experimental development in 1921-1922 of the basic process of natural aeration and filtration, without the aid of chemicals, that has made the Memphis public water supply of such exceptional quality that it has been accorded national recognition—an outstanding contribution to the water works industry in general and specifically to the City of Memphis."

Signatures on the certificate of Citation are those of the following officers of the Memphis Light, Gas and Water Division—

Thomas H. Allen, President
Samuel S. Charr, Vice-President
Ira J. Lichterman, Commissioner
Neander W. Wade, Secretary
C. M. McCord, Director of Water.

Ed. Note: President Allen, if none of the other signers, was connected with the Memphis Water Division at the time that Donaldson was developing the aeration-iron removal process.

A Two-State Sewer District in Kansas-Missouri Plan

A plan to form a joint sewer district in Jackson County, Missouri, and Johnson County, Kansas, south of Kansas City has been discussed by the majority judges of the Jackson County court; Johnson County commissioner; builders and other officials. The group agreed to move toward forming a prospectus.

At the meeting at the county health center in Independence Jack K. Smith, chief of the waste disposal division of the Missouri Health department, said an acute problem exists in the Indian creek area. Officials described the sewer problem south of Kansas City as one of the worst facing the county. It has been estimated the population of the watershed would increase 50 per cent by 1959, they said.

The joint district was recommended in a report made for the Jackson county court by Prichard & Associates, consulting engineers. Black & Veatch, consulting engineers, have made a report on the Johnson County district.

"Good Enough" is NOT Enough!

Blessed are they who were never satisfied to "let good enough alone." All the progress the world has made, we owe to these individuals.

Cleaned Filter Cloth Lasts Longer

Effective washing method developed at Baltimore materially extends life of vacuum filter cloth

by C. E. KEEFER, *Deputy Sewerage Engr., Dept. of Public Works, Baltimore, Md.*
Editorial Associate, Water & Sewage Works

ONE of the items of expense involved in dewatering sludge by vacuum filtration is the replacement cost of filter cloth. Replacing worn or clogged filter cloths with new ones is expensive not only because of the cost of the cloth but also because of down-time and labor involved in the replacement operations. Any procedure, therefore, which will prolong cloth life is important to a sewage works.

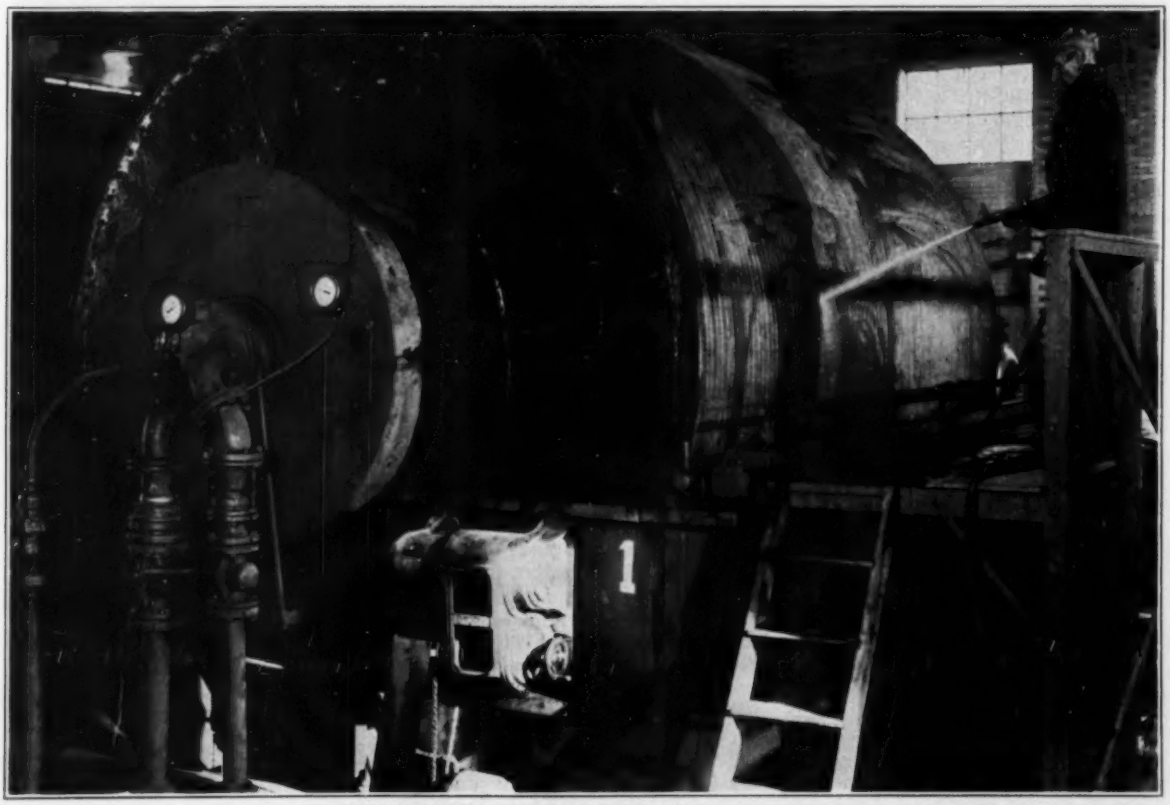
In the past 15 or 20 years during which vacuum filters have come into general use, several procedures have been developed for prolonging the life of filter cloths. For example, the life of filter cloths has been extended at Minneapolis-St. Paul, Minn.[1] by reducing the amount of lime used for coagulating purposes. At Buffalo, N.Y.[2] decreasing the spacing of the spiral wound wire on the filters and a weak muriatic acid wash were used to prolong filter-cloth life. Rudolfs[3] stated that the use of oxalic acid at Washington, D. C., increased filter-cloth life by 30 per cent and the application of copper sulfate reduced fungus growths.

Cleaning filter cloths with an oakite solution[4] followed by clean water is reported to add to the life of cloths. Flood[5] indicates that cleaning cloths with a bath containing hydrochloric acid and an inhibitor prevents the build-up of carbonates and prolongs the life of cloths by 150 to 200 hr. Van Kleeck[6] stresses the desirability of not using lime with a high magnesium oxide content for coagulating purposes, as this chemical ruins filter cloths. A number of other authors have provided useful data with reference to the life of filter cloths[7-11].

Baltimore Experience

During the past few years, the life of the filter cloths at the Back River sewage-treatment works serving Baltimore, Md., has exceeded 4,000 hrs. Since this filter cloth life is many times that at most installations in this country, the procedure followed in Baltimore to keep cloths in working condition and in prolonging their life, is of interest.

The sludge is dewatered on four vacuum filters, each of which has an effective area of 500 sq. ft. The filters



CLEANING vacuum filter cloth with high pressure spray

Life of Filter Cloths in Several Municipalities

Location	Year	Hours of Service	Type of Sludge	Coagulant Used	Kind of Cloth	Reference No.
Annapolis, Md.	.....	1,200	Digested primary[1]	$FeCl_3$	.....	7
Auburn, N.Y.	.....	661	Raw primary	$FeCl_3$ & Lime	Cotton	8
Baltimore, Md.	1952-54	4,155	Digested[1,2]	$FeCl_3$	12-oz. wool	...
Barberton, Ohio	.....	300	.....	.....	12-oz. Canton flannel	9
Birmingham, Mich.	.....	200	Dig. primary & act.	$FeCl_3$ & Lime	Cotton	10
Buffalo, N.Y.	1940-41	211	Digested primary	$FeCl_3$ & Lime	Canton flannel	11
Chicago, Ill.						
Calumet Plant	.....	1,500	Raw activated	$FeCl_3$	13-oz. wool	12
Circleville, Ohio	.....	72	.....	.....	.....	9
Cleveland, Ohio						
Southerly plant	1951	439	Dig. prim. & act.	$FeCl_3$ & Lime	.....	13
Westerly plant	1951	203	Digested primary	$FeCl_3$ & Lime	.....	13
Columbus, Ohio	.....	150–200	Dig. prim. & act.	.....	Canton flannel	9
Cortland, N.Y.	.....	160	Digested	$FeCl_3$ & Lime	.....	14
Dearborn, Mich.	.....	540	Raw primary	$FeSO_4$ & Lime	8-oz. duck	15
Detroit, Mich.	.....	300–340	Raw primary[2]	$FeCl_3$ & Lime	10-oz. cotton flannel	16
Greece, N.Y.	.....	125	Raw prim. & act.	$FeCl_3$ & Lime	Cotton	9
Hackensack, N.J.	.....	217	Dig. prim. & act.	$FeCl_3$ & Lime	.....	17
Hagerstown, Md.	.....	300	Dig. prim. & act.	$FeCl_3$ & Lime	Muslin	9
Hampton Roads San. Dist., Va.						
Army Base plant	.....	150–200	Digested primary	$FeCl_3$ & Lime	Canton flannel	14
Boat Harbor plant	.....	150–250	Digested primary[1]	$FeCl_3$	Canton flannel	14
Hartford, Conn.	1951-52	400	Digested primary[1]	$FeCl_3$	Wool	18
Lansing, Mich.	.....	400–500	Digested	$FeCl_3$ & Lime	8-oz. Canton flannel	14
Menasha, Wis.	.....	393[4]	.....	.....	Canton flannel	...
	.....	643[5]	.....	.....	Canton flannel	9
Milwaukee, Wis.	.....	900–1000	Raw activated	$FeCl_3$	8-oz. Canton flannel	14
Minneapolis-St. Paul, Minn.	1949	539	Raw primary	$Fe_2(SO_4)_3$ & Lime	.....	19
Muskegon, Mich.	1945	473	Digested	$FeCl_3$ & Lime	Canton flannel	9
New Britain, Conn.	.....	500	Raw[4]	$FeCl_3$ & Lime	Cotton duck	9
New Brunswick, N.J.	.....	72–120	.....	.....	Muslin	9
New Haven, Conn.	.....	400–600	Raw primary	.....	Cotton	9
Oklahoma City, Okla.	.....	400	.....	.....	Victor flannel	19
San Diego, Calif.	.....	800	Digested primary[1]	$FeCl_3$	Wool	14
Springfield, Mass.	.....	600–700	Digested primary[1]	$FeCl_3$	12-oz. wool	20
Tonawanda, N.Y.	.....	250	.....	.....	10-oz. Canton flannel	9
Troy, N.Y.	.....	140	.....	$FeCl_3$ & Lime	.....	14
Troy, Ohio	.....	100	.....	$FeCl_3$ & Lime	Cotton flannel	9
Washington, D.C.	1951	1,000†	Digested primary[1]	$FeCl_3$	.....	21

1. Elutriated.
2. Mixture of primary, activated & humus tank sludge.
3. Digested sludge is also mixed with the difficult "winter sludge."
4. In winter.
5. In summer.
6. Sludge from the Guggenheim process.

are operated 24 hrs. a day on either a 6 or 7-day week basis. The filter medium consists of 12-oz. wool cloth, held in place by 12-gauge stainless steel wire. Only digested sludge with a volatile content of about 50 per cent (dry basis) is dewatered. The sludge is derived from municipal sewage from a separate system of sanitary sewers. It contains approximately 71 per cent of primary settling tank material, 9 per cent of activated sludge and 20 per cent of humus-tank sludge.

Prior to March 1952, the sludge was coagulated with chlorinated copperas. To increase the yield from the filters and to eliminate the operating difficulties associated with making this coagulant, ferric chloride has been used since the above-mentioned date. During the 3½ year period from the latter part of 1948 to March 1952, the filter-cloth life averaged 2,037 hrs. Since then, the average life has been 4,155 hrs.

Cleaning Method

The long life of the filter cloths is attributed to the method of cleaning. Each cloth is cleaned for about ½ hr. every 8 hrs. with a low-pressure water spray. When this procedure fails to clean a cloth, it is then cleaned by means of a shade-tree sprayer with water under high pressure. In addition to the necessary high-pressure hose and nozzle, the equipment consists of a pump capable of delivering 22 gal a minute at a pressure of 700 to 900 lbs. per sq. in.

When a cloth is being cleaned, the filter is rotated slowly and the operator holds the nozzle about 5 or 6 ft. from the filter while he applies the high-velocity stream of water to the cloth (Fig. 1). It is essential that the spray is not directed for too long a time on any one part of the cloth, otherwise the cloth will be injured. A cloth for a 500-sq. ft. filter, that is rather badly blinded, can usually be cleaned in 4 or 5 hrs. by this method. The spray equipment is also used to clean the outer surface of the filter drum beneath the cloth when a new cloth is applied.

The operating life of filter cloths at 35 sewage treatment works in the United States is given in the accompanying table. The hours of service per cloth as indicated therein has varied from a minimum of 72 at Circleville, Ohio, to 4,155 at Baltimore, Md. Only two plants listed in the foregoing table, namely those at Baltimore, Md. and Chicago, Ill., report a life equal to or greater than 1,500 hrs. In general, it appears from the table that the use of lime as a coagulant results in reducing the operating life and elutriation prolongs it (Baltimore dewaters elutriated sludge and does not use lime). Dewatering digested sludge usually resulted in a longer cloth life than dewatering undigested material. In connection with the life of filter cloths as indicated in the table it is interesting to note that Faber[20] made a survey of the life of cloths in 38 plants in 1940. At that time he found the life varied from a minimum of 100 to a maximum of 4,000 hrs.

With the present cost of filter cloths $207 each, in Baltimore, the spraying equipment has paid for itself many times. The equipment has the added advantage that it can be used for other purposes such as spraying trees and shrubs, removing incrustations in pipe lines, washing automobiles and trucks and cleaning fine screens.

The Black River sewage-treatment works is under the general supervision of P. L. Holland, Director, Department of Public Works and John J. Hunt, Sewerage Engineer.

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Filmstrips for Training Public Health Personnel

"Small Water Treatment Plants" and "The Drilled Well" are the titles of two Filmstrips released by the Audio-Visual Production Services, Communicable Disease Center, P. O. Box 185, Chamblee, Ga. These are available on free loan for training personnel, or can be purchased.

The filmstrip on water treatment plants is designed to aid in teaching the operating principles of small filtration plants; it describes the impurities which must be removed, and the function of each treatment unit. The filmstrip on drilled wells illustrates, for sanitarians and sanitary engineers, proper construction and protection procedures.

Record Attendance Established by 23rd Arkansas Water & Sewage Conference

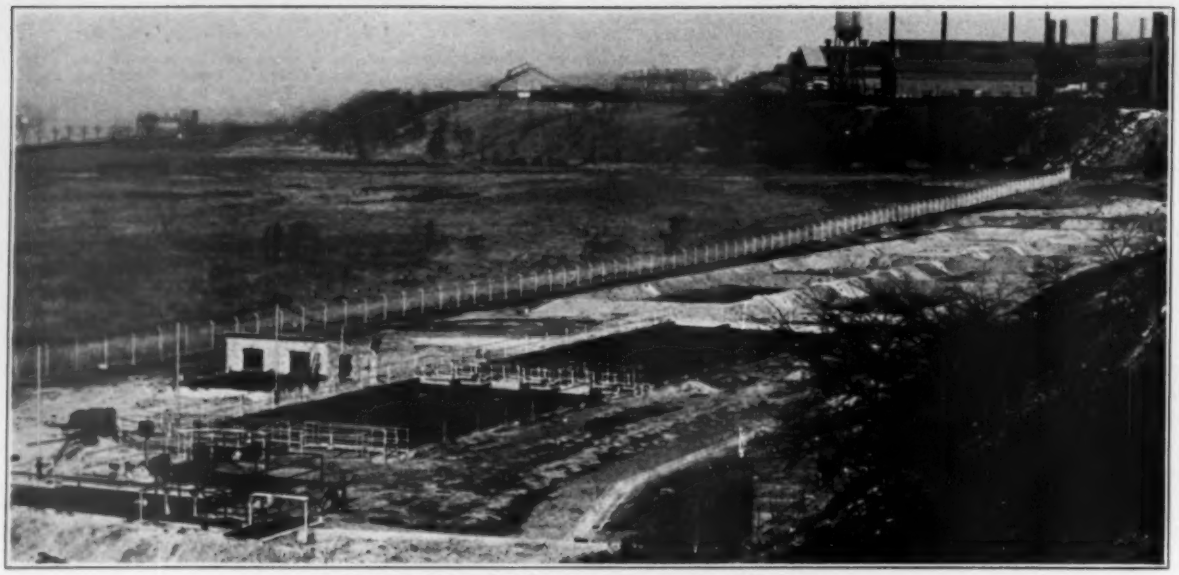
The 23rd Annual Arkansas Water & Sewage Conference, held in Little Rock, Ark., March 22-24, proved to be the record breaking conference in regard to members attending—213. The previous high registration was 193, so the Arkansas Conference continues to grow in size and usefulness to water and sewage works operators of Arkansas.

Elected to offices were the following:

Chairman—A. O. Chastain, Wynne, Ark.
Vice-Chmn.—Lou Embree, Magnolia, Ark.
Secy.-Treas.—Harrison Hale, Magnolia, Ark.
Asst. Secy.—C. W. Oxford, Fayetteville, Ark.
Prog. Chmn.—L. R. Heiple, Fayetteville, Ark.
Exec. Comm.—A. O. Chastain, Wynne; S. Sanderson, Marianna; Homer Ridley, Newport; Harry White, Pine Bluff; James Coe, Fayetteville; E. F. Lunsford, Mena; M. J. Linebarier, Camden; Gayland Strong, Clarksville.

The Arkansas Water and Sewage Conferences comprise a combination of technical sessions and the Annual Water and Sewage Schools followed by examinations of those desiring to become "Licensed Operators" under the voluntary licensing system of Arkansas.

[Ed. Note: For the group photograph of the Conference we are indebted to Dr. Harrison Hale who we believe has served as Secy.-Treas. of the Arkansas Water and Sewage Conference since its inception some 23 years ago.]



SPANG-CHALFANT industrial waste treatment works
L. to R.—Detritor, primary tanks, secondary separators, sludge lagoons

Pipe Mill Waste Water Treatment

National Supply Co. plant discharges treated effluent, cleaner than Ohio River water

by **M. G. VAN VOORHIS**, *Ketchum, MacLeod & Grove, Inc., Pittsburgh, Penna.*

THE Spang-Chalfant plant of The National Supply Co. at Ambridge, Pa., is 20 miles down-river (northwest) from Pittsburgh and five months ago it discharged an average of 5 mgd of untreated industrial waste into the Ohio River, adding its burden to that grossly polluted stream.

With recent completion of a new waste water separation plant there, that situation is completely changed. Now waste water is cleaned before it empties into the Ohio river; in fact the effluent discharged to the Ohio River is cleaner than the river itself.

A New Waste Treatment Plant

The Spang-Chalfant plant's industrial waste is largely from processes used in the manufacture of seamless tubing and oil country tubular products. It contains mill scale, dirt, and sand, all combined with oil and grease, some of which makes a black sludge. This waste is almost odorless, contains comparatively little acid and no sanitary sewage, both of which are disposed of by other means. Much of the time the effluent has a pH slightly on the alkaline side.

The new industrial waste treatment plant is the first of its type to be completed in the Pittsburgh area in compliance with the new state law which requires all industries and municipalities to treat industrial wastes and sewage before discharge into the rivers. Spang-Chalfant engineers found no comparable treatment in similar plants in the area on which to base a

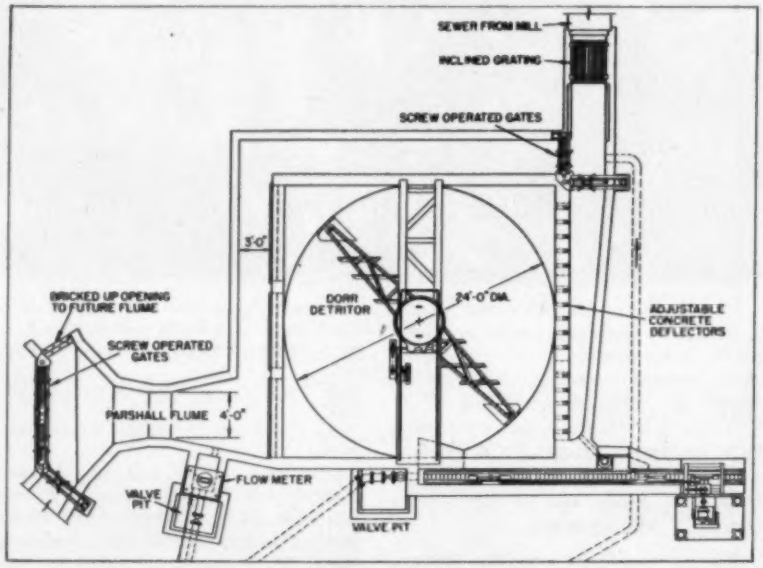


Fig. 1—PLAN of detritor and Parshall flume

design. Standard waste water treatment equipment developed by the American Petroleum Institute for oil refineries, however, was found to be suitable with additional provisions for preliminary removal of large volumes of settled solid particles and sludge, most of which is a combination of fine solids with oils and grease. The completed plant has a capacity of 10 mgd, with provisions for a 33 per cent increase in capacity.

No direct benefit is derived from the installation by the Spang-Chalfant plant. Unfortunately, the pipe mill is unable to re-use the water that it empties into the river because it has no pumping equipment of its own. The Ohio River and the community, however, benefit from cleaner water which means better fishing, pleasure boating, and perhaps eventually, safe swimming. When similar installations by other plants and new municipal sewage plants on the Ohio, Allegheny, Monongahela, Youghiogheny, and other tributaries above Ambridge have been built, the water supply of the Spang-Chalfant will be improved. It is hoped that this will reduce the amount of maintenance and shutdowns of plant equipment for cleaning out plugged piping.

Plant Occupies Two Acres

The new industrial waste treatment plant occupies nearly two acres of ground 100 ft. wide and 800 ft. long parallel with the river. It is about 25 ft. above normal river level and 75 ft. below the main mill floor level where the plant makes its seamless tubing and oil-country tubular products. More than half of the 2-acre area is occupied by eight earthwork basins each of which are 100 feet long and 40 feet wide on bottom. These are sludge lagoons where sludge and oil from any of the six separator basins and a scum pit are delivered. Liquid separates from sludge in these basins, by evaporation and runoff.

Fig. 2—DORR Detritor

The active parts of the waste treatment plant are designed to separate solids and oil from water by several progressive steps in concrete basins and channels that required 1500 cu. yds. of reinforced concrete. The first separation is by a simple trash rack that keeps comparatively large solids out of the plant. A large furnace-lining brick has been caught on the grating among other lighter weight debris.

Next is a 24-ft. square settling basin, the Dorr Detritor, (Figs. 1 & 2) which has a depth of 4 ft. and normal water depth of 2½ ft. In it, a rotary scraper turning at 0.25 rpm carries settled material outward into scoops on its two ends which push this material into a submerged trough. Mechanized "hoes" continuously pull the detritus out and up an inclined trough out of which it drops onto the ground where it can be scooped up and trucked away.

In order to prevent turbulence in the detritor, water from the 36-in. diameter mill sewer makes a 90-degree turn into the detritor guided by 15 adjustable cconcrete deflectors in a 21-ft. opening that is a little more than 2 ft. high. A 3-ft. wide by 4 ft. deep by-pass is provided. Two screw-operated gates at the entrance corner of the detritor control the flow through or around it.

Before overflow water from the detritor reaches the primary settling basins, it passes through a Parshall flume which permits an accurate measure of the rate of water flow. A Builders-Providence recording flow meter, with circular one-week chart, which is supported on a pedestal beside the flume, shows flow rates in gallons per day. The instrument is protected against freezing in winter by a small electric heater.

Three screw-operated gates at the end of the Parshall flume allow the water normally to enter any of three flumes leading to three primary settling tanks. A fourth opening which is bricked up provides for possible

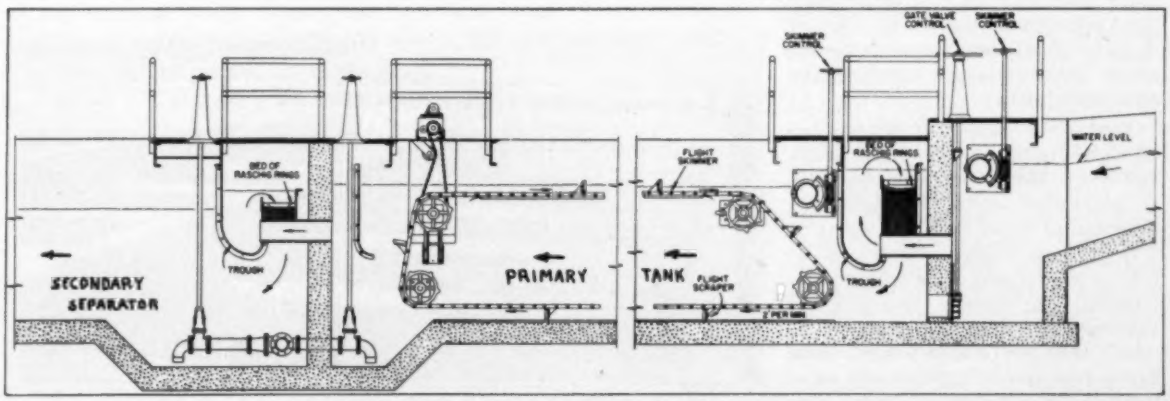


Fig. 3—CROSS SECTION of primary and secondary separator tanks

Fig 4—PRIMARY tanks, foreground; secondary separators, rear

future installation of another primary and secondary separator.

Primary Separator

Water enters the primary tanks by way of 14-ft. distribution boxes across the ends of each tank, through nine 10-in. diameter pipes into the bottom of each box. The water in these boxes overflows down through 14-ft. film rupture trays containing beds of 2-in. diameter ceramic Raschig rings into the main settling basins, which are 14 ft. wide and 90 ft. long, equipped with sludge and scum removal flights. (See Fig. 3, 4, & 5).

The bed of Raschig rings helps to separate and break up contaminating material that ordinarily would not readily separate from the water by gravity. The boxes and Raschig ring beds also serve to prevent turbulence by uniformly distributing the flow across the end of the settling tanks.

Surface oil that accumulates in the flumes at the entrances of the primary separators is removed occasionally through a rotating scum removal pipe. An attendant turns the hand-wheel of the horizontal, slotted 12-in. diameter drain pipe, which is partially above water level, until the oil flows through the longitudinal slots into it. This oil flows by gravity into a square concrete pit or "scum decanter" which adjoins the pump house.

Settling of solids and flotation of oil occurs in the primary tanks where full-width sludge scrapers spaced 5 ft. apart push settled material in the direction of water flow at a speed of 2 ft. per min. Sludge collects in pockkets at the far end from whence it is pumped out. Scraper blades act as skimmers as the endless chains to which they are attached carry them to the surface of the water and move them in the opposite direction. Surface oil accumulates beside the distribution box where it is drained off occasionally through slotted drain pipes like those in the entering flumes.

Secondary Separators

From the primary tanks, waste water flows into adjoining ends of three secondary separator basins by way of distribution boxes containing shallower beds of Raschig rings than those at the intake ends of the primary separators. (See Fig. 3) The distribution box is at a lower level than in the primary separator. The three secondary separators are of the same width as the primary tanks (14 ft.) but are 127 ft. long and have no scrapers or skimmers except slotted, rotatable drain pipes at the far end like those in the primary tanks. The outflow ends of the secondary separators are approximately 3 inches lower than the intake ends. Water flows by gravity from the lower end through a sump into a 36-in. concrete sewer to the river. The sump also receives surface water from a 3-ft wide concrete trench located on the hillside above the waste treatment plant. This trench is 30 to 50 feet from the separator plant, extends its full length and is located to prevent surface runoff from flowing into the plant site.

Sludge collected at the adjoining ends of the primary and secondary settling tanks is pumped into any of the eight lagoons. The pumps also can take sludge from the scum pit beside the pump house and discharge it to the lagoons. When the solids content of the sludge is low, it can be returned to the detritor from either the settling tanks or the scum pit. This practice makes it possible to thicken the sludge, if desired.

Sludge is pumped by 4-in. Marlow sludge pumps, duplex type, connected in parallel to 6-in. suction and discharge lines. Normal capacity is 6300 gph with a maximum of 8400 gph. The pumps have 9-in. dia. plungers that operate with a stroke that can be varied from 3.86 to 6.56 in. Maximum working pressure is 65 psi and the pumps are driven by 5-hp electric motors.

Special precautions were taken with scum pit construction to prevent it from being buoyed up by flood waters which have covered this area in the past. Concrete walls of this pit, which is 19 by 21½ by 14 ft deep, are 2 ft thick at the bottom and taper up to 1½ ft in thickness. The concrete base slab, 25 by 22½ ft, is 3 ft thick. Total weight of the empty pit is about 20 per cent over maximum possible water displacement.

It has been impossible to estimate the amount of material removed by the treatment plant in any given period of time, but, during five months of partial operation, many tons of material have accumulated in the scum pit, and many tons of waste discharged by the detritor have been hauled away.

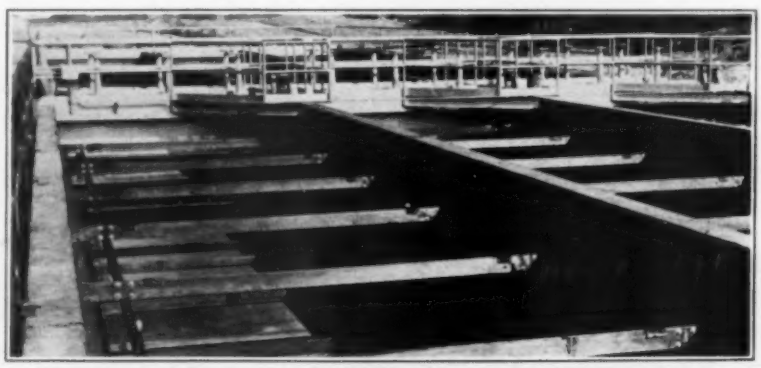


Fig. 5—EMPTY primary tanks showing sludge scraper and oil skimmer flights

REPORT FROM ABROAD

About Alternating-Double-Filtration and a New Activated Sludge Plant

by **JOHN FINCH**, *Manager, Sewage Disposal Department, Rotherham, England*

TWO years ago, the writer's "Report from Abroad" stated that the processes of alternating-double-filtration was making a name for itself in Great Britain, and that the activated sludge process had met with a competitor of some moment. This statement was based on developments in the sewage treatment field at that particular time, and it took account of the alternating-double-filtration schemes then in the process of building and those in operation.

By now the operating results of quite a number of these schemes should be coming through; but alas, reports are very hard to come by. The information awaited by many interested authorities is just not sufficiently available for one to form a general opinion of the operating efficiencies of the various plants (as constructed under British loadings, and producing effluents up to the rather high standards of quality demanded by the River Authorities in this country). These reports will be forthcoming in due course but, until they are available, the lack of data on operating installations—from the smallest to the largest—has lessened support of the system. Furthermore the recent findings of the O.E.E.C. Report in respect of the activated sludge process has caused a somewhat greater interest to be taken in that process.

The Water Pollution Research Board still is carrying out investigations into the various ramifications of alternating-double-filtration, and has published certain of its findings.

W.P.R. Board Investigations

Very recently there have arisen, as a result of some of the investigations by the Water Pollution Research Board, many discussions as to the necessity or desirability of installing humus tanks to follow the primary filters in alternating-double-filtration schemes, and as yet the answer is not at all clear. It is fair to say that much more work must be done before conclusions of moment can be drawn.

The Water Pollution Research Board reports that, in two experiments, it has found only a slight reduction to result in the quality of the final humus tank effluent when settlement of the primary effluent is omitted in the process of alternating-double-filtration. The report also states that the most striking effect of the omission of intermediate sedimentation is to cause an increase in the amount of solid matter discharged from the secondary filter. Apparently the omission of intermediate sedimentation may be expected to cause some deterioration in the condition of the filters, although there was little evidence of this at Coventry where the investigations were carried out.

One question often asked in regard to this work is whether to omit the humus tanks following the primary filter and to spend the money thus saved on additional filter capacity, or to cut the size of the filters and include the humus tanks.

At a recent meeting where the W.P.R.B. staff presented their findings on this problem, a delegate made the point that, with a well granulated sample of humus sludge, fifteen minutes retention would effect a fifty per cent removal of these solids. In consequence, primary filter settling tanks need be neither large nor expensive to effect considerable reduction in the humus solids content of the primary filter effluent.

Another delegate, in criticising the work of the W.P.R.B., said that in investigations of this nature the work should necessarily be carried on for longer than one year in order to give the percolating filter adequate time to adjust itself to the prevailing conditions. In time, the changed conditions might easily cause clogging of the filter material and a consequent deterioration in the capacity of the unit, coupled with a falling-off in quality of the effluent. There is a certain amount of cogency in this argument against short-term investigations, particularly in this type of investigation. Certainly the elimination of one set of humus tanks in an alternating-double-filtration scheme would make a substantial capital saving, and perhaps be a deciding factor in the choice of such a scheme as opposed to say the conventional alternating-double-filtration scheme with two sets of humus tanks.

Investigations of this type definitely should be continued in view of the benefits that might conceivably accrue as a result. We're still very much concerned with discovering the most economic process which is consistent with a *good standard of effluent* to meet the stringent River Authority standards now in force in Great Britain; in some areas these specify not more than 10 ppm suspended solids, with B.O.D. figures of 20 ppm as a maximum, to be improved upon if possible. Whilst it is by no means impossible to produce effluents of this type by activated sludge, in many instances the percolating filter installation has failed on the suspended solids requirement.

Dr. Harold Wilson, the President of the Institute of Sewage Purification, said that plants in South Africa had not produced the results anticipated when dealing with strong sewages and had been rather disappointing in operation. However, he did not enlarge on the subject or give any details as to how the system had failed to live up to expectations, which is a pity, as a considered statement from an authority of Dr. Wilson's calibre would have been of the greatest value.

What of the Future?

One cannot help but wonder, therefore, what the future of the alternat-

BIRMINGHAM—percolating filters were converted to alternating-double-filtration in 1952
An "important and significant decision" commented the author at that time.

ing-double-filtration process is likely to be. Quite a few schemes have been constructed and quite a few are building, but operational data is in short supply. One cannot help but feel the early optimism, that resulted as a direct consequence of the pioneer work carried out by various authorities, has been discounted to some extent by this noticeable lack of data from full-scale plants now well "run-in." As one speaker put it; "alternating-double-filtration authorities are not crowding each other to publish the results of their first twelve months or two years activities"; but the Water Pollution Research Laboratory still continues its very good work to fathom the potential of this fascinating process of sewage treatment.

At the same time, there is a renewal of interest in the activated sludge process since the comparatively recent "hotting-up" of the mechanical aerators.

An example serves to illustrate this situation. In a paper given to the Institute of Sewage Purification a few months ago, Winsor describes the operation of the Coleshill Sewage Treatment plant of the Birmingham Tame & Rea District Drainage Board. He states that experiments have been carried out, when conditions were suitable, by reducing the number of aeration tanks in use at Coleshill while still maintaining the same flow of sewage, activated sludge return and air output. When the cubic feet of air per square foot of aeration tank surface was thus increased from 6.7 to 10 (or an increase of 50 per cent), the resulting improvement in activated sludge solids more than compensated for the decreased time of retention in the aeration tanks.

The Birmingham authorities are proceeding with their investigation. They are installing additional air compressors, to provide a more generous supply of air to the system, and are planning to recondition the diffuser tiles. This work will be watched most carefully as, indeed, are all the Birmingham investigations.

London County Council Sewage Schemes

The London County Council Beckton Sewage Scheme (Northern Outfall) is proceeding apace and a great deal of interest is being displayed in what constitutes the first major sewage scheme to be constructed since the end of World War II.

It will be recalled that the Beckton plant is part of the plan to end pollution of the Thames estuary, which will in due time also include the Southern Outfall plant at Crossness. Together these two schemes will treat the sewage from a population of something like 4.5 million persons, providing a dry weather flow of approximately 300 mgd, and a storm water flow of the order of 1200 mgd!

The Beckton extensions include the construction of detritors, primary settling tanks, additional activated sludge units and sludge digestion units. Rectangular tanks will be used in the sedimentation of raw sewage, and the sixteen tanks 250 ft. long by 75 ft. wide and are to be fitted with Mieder scrapers. The total capacity of this installation will be about 20 million gallons, and provision is made in the scheme for the construction of an additional set of tanks to double the plant capacity.

The raw sewage entering the works will pass through six screen channels, each containing a coarse and fine screen, mechanically operated, the screenings from which will be disintegrated and returned to the sewage flow. On its way to the primary settling tanks the sewage will be pre-aerated.

Combined Treatment Plants

The diffused air activated sludge plant included in the extensions will treat about 60 mgd, and will provide six aeration units, each divided into eight channels. The plant may be operated under step aeration or tapered aeration principles, and will be followed by 15 clarifiers, each 100 ft. in diameter. Interestingly enough, the Beckton scheme will continue to use the old Hartley patent inclined paddle-type aeration plant in open and tunnelled channels arranged one above the other. The old plant originally was installed to treat 60-70 mgd, and thus the activated sludge treatment can be applied to a total flow of more than 120 mgd of settled sewage.

The most interesting feature of the L.C.C. scheme is the installation of Ruston & Hornsby gas turbines which will produce the compressed air for the activated sludge plant and most of the electricity required by the whole works. Eight gas-turbines have been placed on order at a cost of £635,000. Five of the turbines will be used for driving the centrifugal blowers, each capable of delivering 25,000 cu. ft. of free air per minute at 7.5 lbs. pressure; and the remaining three will be used for driving alternators of 750 kw. capacity.

The supply of gas to the turbines, at 100 lbs. per square inch, will be obtained from a separate gas-compressing station; and the turbines will be air-cooled, water being used only for the lubricating oil cooler. The heat requirements of the sludge digestion plant will be supplied by arranging for the exhaust gas to pass through water heaters. The turbines will be equipped for burning oil in addition to gas from the digestors, as a means of starting up operations and as a stand-by in the event of gas shortage or failure.

Research Relating to Design

Few people really appreciate the tremendous amount of research and investigation that recently has been undertaken by the L.C.C. at Beckton. This relates to the extensions to the new plant now under construction or in the design stage; much of the research has been described in technical journals.

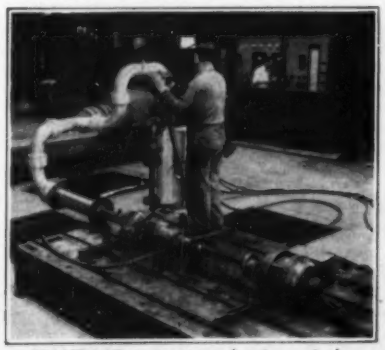
Although some of these studies are essentially related to problems peculiar to the L.C.C.'s schemes, they are of interest to workers in the sewage treatment field generally. The studies include: further investigations into the freezing of sewage sludge, related to the removal of water after subsequent thawing and filtration; the availability of nitrogen in sewage sludges, insofar as it has a bearing on the prices that could be obtained for the dried sludge after a freezing process; the digestion of activated sludge, with special reference to nitrogen balance. The latter study has been undertaken mainly to give preliminary data on the practicability of reducing the bulk of Beckton surplus activated sludge, and is a follow-up of work carried out at one time at the Manchester works by Dr. Ardern and W. T. Lockett. Other studies relate to operation of diffuser tile cleaning using chemicals, and to the operation of a new type of heater in the sludge digestion process.

An investigation into the distribution of the flow at the Northern Outfall Works showed interesting results, and was found to be similar in pattern to an investigation of the same nature carried out 20 years previous. The peak flow, in mid-afternoon, reached a rate of 300 mgd against about 100 mgd at 6 A.M. Generally the period of greatest flow coincided with the period of greatest strength, fairly common at plants in this country, and about 14 per cent of the total polluting load was imposed for an hour at 4 P.M. The total oxygen demand (in terms of oxygen absorption from acid permanganate) ranged from 1.6 tons to 5.2 tons per hour, a range of oxygen absorption varying between 30 ppm to 95 ppm. The suspended solids varied between 3.3 to 13.7 tons per hour, or about 60 to 250 ppm, figures which are quite consistent with a per capita flow of 65 gal. per day—an "average" sewage by the old Ministry of Health standards.

Worthington's New Hydraulic Test Laboratory in Operation

One of the world's largest, newest, most complete and flexible hydraulic test laboratories of its kind was recently demonstrated to a group of technical editors from the New York area at the Harrison Works of Worthington Corporation. The laboratory covers over 20,000 square feet at the 43 acre Harrison plant and has been over 3 years in the planning and building. With this hydraulic laboratory, Worthington is now able to test more and larger pumps than ever before with standard plant facilities.

Designed basically for production or performance testing, the huge "hydraulic proving ground" will also be a valuable tool for applied research and development of fluid handling machinery. It will enable experimental confirmation of theoretical calculations and aid in the projection of future designs and in improving performances. Engineers will more readily be able to determine the full performance characteristics of the pump to a greater degree of accuracy.



STANDARD test set-up showing swivel-joint-arm pipe, pump on test, and control room in background.

A "TEST BENCH" covers over 20,000 sq. ft. at the Harrison, N.J. plant.

The Worthington hydraulic laboratory is capable of duplicating hydraulic field conditions for the more than 10,000 different types and sizes of pumps currently being produced. Pumps tested will range in size from fractional horsepower units to those with capacities in excess of 100,000 gallons per minute.

Since many of the pumps manufactured at Harrison are individually engineered for optimum performance and for specific conditions of operation, testing heretofore often required the construction of a special test set-up for each different pump to simulate the field conditions to be encountered. The laboratory now provides a variety and flexibility of set-up arrangements to meet almost every condition and requirement, eliminating the necessity of building special accessories and devices as the particular test demanded.

The standard test set-up area can handle pumps not exceeding 2,000 gpm in capacities or 600 HP. Banks of underfloor venturi meters and permanently installed instrumentation, controlled and observed from a central control room were designed to accommodate a wide variety of production pumps. The counterbalance feature of the swivel-joint-arm pipes supplying water to pumps on test, and similar convenience features make it possible for one man to set up a unit for test.

Should We Own and Maintain House Service Lines?

An Open Letter from One Water Works Man to Another

Dear Bill,

I note that other fellows have been writing to you about research and low water rates, among other things. I'd like to give you an idea to think about. It's a practice we've adopted, namely that the utility owns and maintains the entire service line from the main to the customer's house.

Waukesha, as you know, operates its water utility in Wisconsin, where the State Public Service Commission controls water rates and operation of municipal as well as private water utilities. It is under this PSC system, too, that municipal water utilities are allowed to operate at a fair profit, just like any private utility. Our water utility supplies a world famous water to some 22,000 customers under water utility commission operation.

As I indicated, Waukesha's Water Utility operates under the PSC Rates and Regulations; it pays city taxes on about 80 per cent of the value of the properties it owns. The city in turn, pays for public fire protection based on the number of miles of mains and the number of hydrants (14 cents per year per foot of mains 6 inches and above, and $15.75 per fire hydrant) and for water for drinking fountains, sewer flushing and street wetting. Waukesha, too, is one of the few cities, if not the only city in the U.S., where the water utility has an employee profit sharing plan.

How It Happened?

How we came to go into this matter of owning and maintaining the customer's service lines stems from a PSC ruling some years ago. This ruling stated that if a service line needed replacement, the utility had to replace the line from the main to the curb, at the utility's expense.

Back in 1933, when a Pitometer survey was made, it was found that there were many leaky service lines, where replacements were necessary. The customer, of course, had to replace his part of the line from the curb to the house, while the water works did its share from the curb to the main. Many customers didn't like the idea. Since there was a wide variety of sub-soil conditions, contractors didn't want the replacement jobs because of the grief involved. Plumbers, likewise, didn't want the jobs and bid too high on the work. As a result, the Utility had to do the job and charge the customer for his share.

This was the practice until 1948, when we had another Pitometer survey, which showed about a 10 per cent loss of water through leaks. A year later, we decided that wherever replacement of service lines is necessary, the Utility would replace the entire service from main to the house. It was decided that the cost of the work would be capitalized as book cost. Under this arrangement, the cost of the work could be included in the basis on which water rates and earning power are based.

Of course, the Utility already owned the meters. Now, it would own the entire system including mains, services and meters and the Utility announced that henceforth it would take over and maintain all house service lines, both old and new.

Any Problems?

I know you're going to ask a couple of questions: What if a customer wants a refund on his investment in a service line already installed? And, what legal problems were raised in reference to right of way?

As to the first question: Only one man made such a request; he had a copper service line which he had installed only the year before. When the rule was explained to him he was glad to have us assume all costs and responsibility from now on. Apparently, all other customers were content with the idea that if and when maintenance was needed, the Utility would do the work, and therefore, they, the customers would be glad to give up whatever equity they had in the old line.

As to the second question: Not one single customer raised the question of right-of-way. Of course, this idea is not entirely new, since private gas and electric utilities own service lines from their main lines to the customers' houses.

Replacement Program and Costs

Right now we are replacing about 25 old services each year. That's only about one per cent of all the old services. Naturally, we don't expect to take 100 years to replace all of the old services. As time goes on, we shall probably replace more and more old services, each year.

We have established as a standard, that all house connections will be 1-in. copper lines for both new and replaced services. We used to install ¾-in. house service lines, but with the use of more and more water gadgets in the home, we found that the purely domestic per capita consumption went up 33 per cent in ten years.

With more bath tubs, more washing machines and more garbage grinders, it is apparent that a larger service line is needed for a home. Furthermore, we believe in selling our product, which is water, and we are therefore advocating the use of more water for sprinkling to develop better and prettier lawns. Thus the reasoning behind a standard 1-in. service seems to be sound.

As I've said, sub-soil conditions vary considerably throughout the city and the cost of installation of service lines varies rather widely. On the average, however, replacing an old service line or installing a new one costs approximately $1.50 per foot. There is no limit on old service lines, but on new installations we do set a maximum limit of 50 feet. This limitation is applicable only in new developments where large lots are being used.

In spite of this relatively high cost per foot, we feel that the program is sound public relations. Furthermore, it is sound financially. It is a long term investment of 50 years or so, instead of 10-15 years. The fact that we can include the cost in the basis for rates and earning power, makes it possible to recover the cost from the customer over the years. True, the public pays the bill eventually through water rates, but the program avoids the need for immediate outlay of cash on the part of the customer.

Our customers seem to be sold on the idea. We are sold on its feasibility. What do you think of it?

Yours, Fred

[Ed. Note—"Fred" really is Arthur P. Kuranz, Manager, Water Utility, Waukesha, Wisc.]

CHICAGO SEWAGE EQUIPMENT

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Positive Grit Removal and Washing

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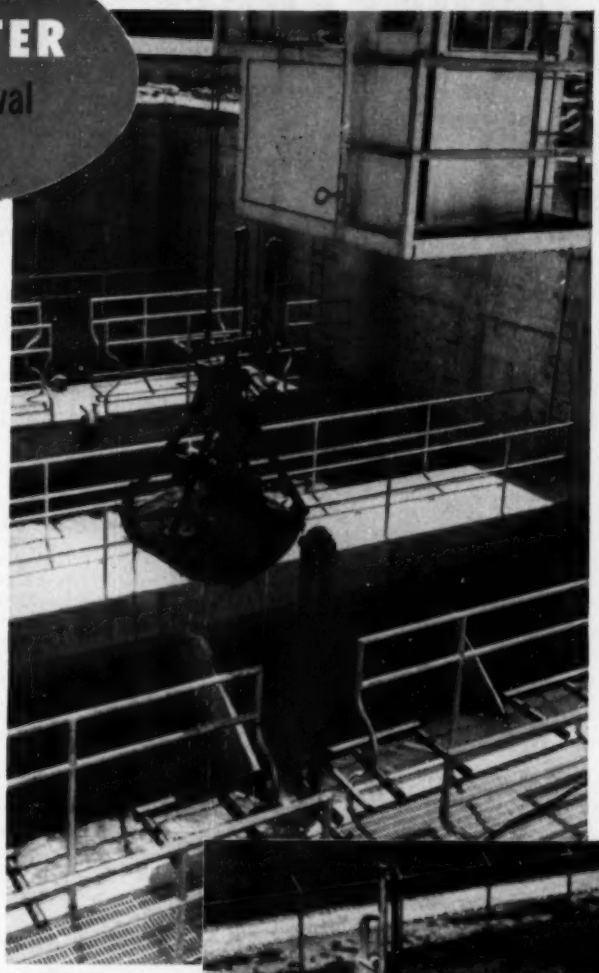
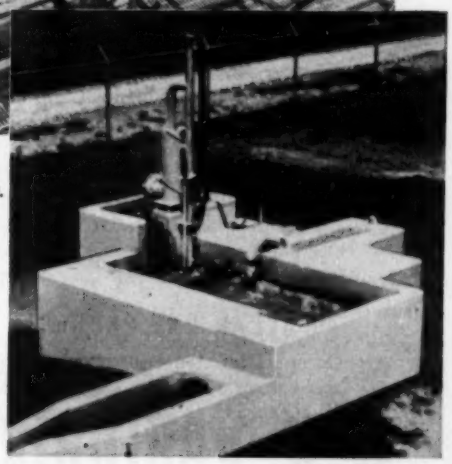
Only a negligible trace—less than 0.5%—of putrescible organics remains in the grit due to the spiral washing action.

Aer-Degritter Systems may be installed in existing structures at the head end of preaeration and grease removal tanks. Aer-Degritters are installed in wet wells of lift stations for grit and odor removal and in power plant and waterworks intakes.



Aer-Degritter,
Columbus, Ohio S.T.P.
Design Flow 160 M.G.D.
Paul A. Uhlmann & Associates, Engineers



Aer-Degritter,
Bellaire, Texas S.T.P.
Design Flow .8 M.G.D.
Hilton & Coulson, Engineers

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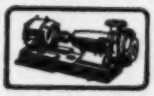

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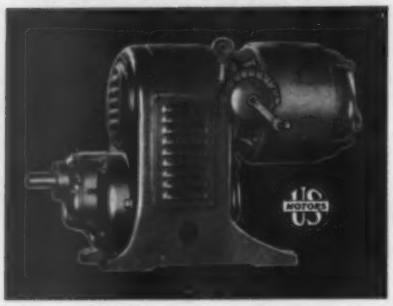

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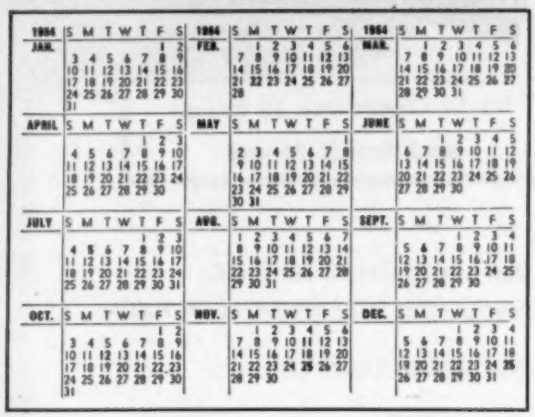
Meetings Scheduled



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May 20—Lawrence, Mass.
NEW ENGLAND WATER WORKS ASSOCIATION. Sec'y, Joseph C. Knox, 73 Tremont St., Boston. Mass.

May 20-21—Staunton, Va. *(Hotel Stonewall Jackson)*
VIRGINIA INDUSTRIAL WASTES & SEWAGE WORKS ASSOCIATION. Sec'y, J. L. Hamrick, Jr., 415 W. Franklin St., Richmond, Va.

May 21-June 4—Chapel Hill, N. C. *(University of North Carolina Institute of Government)*
NORTH CAROLINA SEWAGE & INDUSTRIAL WASTES TREATMENT SCHOOL, Dir. Geo. Esser, Institute of Government, Chapel Hill, N. C.

May 22-24—East Lansing, Mich. *(Kellogg Center, Michigan State College)*
MICHIGAN SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, D. M. Pierce, Room 334 Administration Building, Lansing, Mich.

May 23-28—Seattle, Wash. *(Exhibits and Technical Sessions—Auditorium)*
AMERICAN WATER WORKS ASSOCIATION. (74th Annual Convention). Exec. Sec'y Harry E. Jordan, 521 Fifth Ave., New York 17, N.Y.
(For hotel accommodations apply to A.W.W.A. headquarters office.)

May 25—Seattle, Wash. *(Norselander Cafe)*
PACIFIC NORTHWEST SECTION A.W.W.A. (Luncheon and Business Meeting). Sec'y, O. P. Newman, Boise Water Corp., Boise, Ida.

May 30-June 5—Gainesville, Fla. *(University of Florida)*
FLORIDA WATER & SEWAGE WORKS SHORT SCHOOL & CONFERENCE. Director, David B. Lee, P.O. Box 210, Jacksonville, Fla.

June 7-9—Auburn, Ala. *(Alabama Polytechnic Institute)*
ALABAMA WATER & SEWAGE WORKS SHORT COURSE. (Sponsored by Alabama Water & Sewage Assn.) Director, Alex. O. Taylor, Box 69, Auburn, Ala.

June 7-11—Columbia, Mo. *(University of Missouri)*
MISSOURI WATER WORKS SHORT COURSE. Director, Warren A. Kramer, State Office Bldg., Jefferson City, Mo.

June 9—Lubec, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

June 14-15—Syracuse, N.Y. *(Hotel Syracuse)*
NEW YORK SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Executive Committee Dinner Sunday Evening June 13. Sec'y, R. C. Sweeney, State Dept. of Health, White Plains, N.Y.

June 14-18—Chicago, Ill.
AMERICAN SOCIETY FOR TESTING MATERIALS. Sec'y, Raymond E. Hess, 1916 Race St., Philadelphia 3, Pa.

June 14-19—Atlantic City, N.J. *(Chalfonte Haddon Hall)*
AMERICAN SOCIETY CIVIL ENGINEERS. Exec. Sec'y, Wm. N. Carey, 33 West 39th St., New York, N.Y.

June 17—Rye Beach, N.H. *(The Farragut)*
NEW ENGLAND WATER WORKS ASSOCIATION. Sec'y, Joseph C. Knox, 73 Tremont St., Boston, Mass.

June 22-25—Blackpool, England *(Jubilee Theatre, Coronation St.)*
INSTITUTE OF SEWAGE PURIFICATION. Sec'y, W. F. Freeborn, 34 Cardinal's Walk, Hampton-on-Thames, Middlesex, England.

June 22—Boonton, N.J. *(The Knolls Golf Club)*
NEW JERSEY SECTION A.W.W.A. (Summer Outing). Sec'y, C. B. Tygert, Box 178, Newark, N.J.

June 23-25—Allentown, Pa. *(Americus Hotel)*
PENNSYLVANIA SECTION A.W.W.A. Sec'y, L. S. Morgan, State Dept. of Health, Greensburg, Pa.

June 24-26—Richmond, Ind. *(Hotel Leland)*
CENTRAL STATES SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, A. Paul Troemper, 2029 Bates Avenue, Springfield, Ill.

July 25-31—Sao Paulo, Brazil *(Univ. of Sao Paulo)*
INTER-AMERICAN CONFERENCE SANITARY ENGINEERING. Write to General Secretariat, Fourth Inter-American Conference San. Eng. Caiza Postal 8099, Sao Paulo, Brazil.

Aug. 11—Bingham, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Aug. 23-25—State College, Pa. *(College Dormitories)*
PENNSYLVANIA WATER WORKS OPERATORS ASSOCIATION. Sec'y, R. R. Kountz, Pennsylvania State College, State College, Pa.

Aug. 25-27—State College, Pa. *(College Dormitories)*
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, B. S. Bush, Dept. of Health, Kirby Health Center, Wilkes-Barre, Pa.

Sept. 8-11—Digby, Nova Scotia *(Digby Pines Hotel)*
MARITIME PROFESSIONAL MEETING, ENGINEERING INSTITUTE OF CANADA, ASSOCIATION OF PROFESSIONAL ENGINEERS. Write, G. W. Frey, P.O. Box 1507, Halifax, N.S.

Sept. 9-10—Montauk, N.Y. *(Hotel not selected)*
NEW YORK SECTION A.W.W.A. (Annual Fall Meeting). Sec'y, Kimball Blanchard, 50 West 50th Street, New York, N.Y.

Sept. 14-16—Waterloo, Iowa *(Hotel Russell-Lampson)*
IOWA SEWAGE WORKS ASSOCIATION. Sec'y, L. F. Skorczeski, 207 South 15th Ave., Marshalltown, Ia.

Sept. 15-17—Muskegon, Mich. *(Occidental Hotel)*
MICHIGAN SECTION A.W.W.A. Sec'y, T. L. Vander Velde, Dept. of Health, Lansing 4, Mich.

Sept. 19-22—Atlantic City, N. J. *(Hotel Claridge—Exhibits, Convention Hall)*
AMERICAN PUBLIC WORKS ASSOCIATION. Exec. Dir. Donald Herrick, 1313 E. 60th St., Chicago 37, Ill.

Sept. 20-22—Nashville, Tenn. *(Andrew Jackson Hotel)*
KENTUCKY-TENNESSEE SECTION A.W.W.A. Sec'y, J. Wiley Finney, Jr., 420 6th Ave. N., Nashville, Tenn.

Sept. 20-22—Nashville, Tenn. *(Andrew Jackson Hotel)*
KENTUCKY-TENNESSEE INDUSTRIAL WASTES & SEWAGE WORKS ASSOCIATION. Sec'y, R. Paul Farrell, 420 6th Ave. N., Nashville 3, Tenn.

Sept. 22-24—Dayton, Ohio *(Biltmore Hotel)*
OHIO SECTION A.W.W.A. Sec'y, M. E. Druley, Dayton Power & Light Co., Wilmington, Ohio.

Sept. 22-24—Regina, Sask. *(Saskatchewan Hotel)*
WESTERN CANADA WATER & SEWAGE CONFERENCE. Sec'y, W. J. Waddell, 3610 Manchester Road, Calgary, Alberta.

Sept. 22-24—Grand Forks, N.D.
NORTH DAKOTA WATER & SEWAGE WORKS CONFERENCE. Sec'y, Jerome H. Svore, State Dept. of Health, Bismarck, N.D.

Sept. 22-24—Atlanta, Ga. *(Ga. Institute of Technology)*
GEORGIA WATER & SEWAGE SHORT SCHOOL. Write, A. T. Storey, 1210 Hemphill Ave., N.W., Atlanta, Ga.

Sept. 26-28—Jefferson City, Mo. *(Governor Hotel)*
MISSOURI SECTION A.W.W.A. Sec'y, Warren A. Kramer, State Office Bldg., Jefferson City, Mo.

Sept. 28-30—Green Bay, Wis. *(Northland Hotel)*
WISCONSIN SECTION A.W.W.A. Sec'y, Leon A. Smith, City Hall, Madison 3, Wis.

(Continued on page 92A)

THIS JOINT

to ROOTS

JC-60® STOPS

- ROOT PENETRATION
- INFILTRATION

JC-60 not only stops roots, but turns them away. JC-60 was developed by ATLAS Research Engineers in answer to a long standing need for a root resistant joint in sewer construction. The ability to resist root penetration is the result of two important properties, hardness and adhesion, to a degree that no other jointing compound has equalled. To properly primed clay pipe, JC-60 adheres with a tenacity in excess of 400 psi. Climate extremes, overheating, normal settling and corrosion do not affect the quality of JC-60.

JC-60 will protect your investment for years to come, yet it represents only a slight fraction of the total cost of a sewer system. JC-60 will pay for itself in a short time, by reducing infiltration of surface and soil water. JC-60 directly reduces pumping costs and equipment capacity required in the disposal plant.

Further information concerning ATLAS JC-60 may be obtained by writing for ATLAS BULLETIN M20-3.

OTHER ATLAS JOINTING MATERIALS *include* **GK®** *and* **SLIPJOINT GK®** *for sewer pipe:* **MINERALEAD®** *and* **HYDRORINGS®** *for cast iron water pipe.*

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6 Reasons why

PALMER SURFACE WASH SYSTEMS

are specified by water works engineers

1. **Prevent Sand Beds From Cracking.**
2. **Eliminate Mud Balls.**
3. **Save Wash Water.**
4. **Lengthen Filter Runs.**
5. **Higher Rates of Filtration.**
6. **Better Tasting Water.**

Write today for Bulletin 451 and a list of water purification plants that have gone modern.

STUART CORPORATION
516 N. CHARLES ST., BALTIMORE 1, MD.

Auckland, N.Z., Retains Panel of American and British Sewerage Experts

Faced with problems relating to feasibility and economy, the Drainage Board of the city of Auckland, New Zealand has suspended construction work on the first stage of a sewage collection and treatment project costing approximately $25 million and has employed a panel of five consultants to determine whether the present program should be continued or modified.

Named to the panel are three engineers from California and two from England. Those from California are A. M. Rawn, chief engineer and general manager of the Los Angeles County Sanitation Districts; Charles Gilman Hyde, emeritus professor of civil and sanitary engineering, University of California, and currently a consulting engineer at Berkeley; and Dr. David H. Caldwell, a partner in the San Francisco firm of Brown and Caldwell, consulting civil and chemical engineers.

The two consultants from England are J. T. Calvert, a partner in the London firm of John Taylor and Sons, and Dr. H. Wilson, a consulting chemist, currently president of the British Institute of Sewage Purification.

New Washington Pumping Station Planned for Year 2000

The new Dalecarlia Pumping Station is part of a broad program formulated by the Washington District of the Corps of Engineers to expand and improve the water supply facilities for the District of Columbia and environs. The program is sufficient in scope to meet the anticipated needs of the area until the year 2000.

The present Dalecarlia Pumping Station, which will be abandoned in the future, was first placed in operation in 1928 with nine Worthington centrifugal pumps providing installed capacity of 120 million gallons a day. The station has given satisfactory service throughout the years, but steady growth of Washington and the

surrounding areas has necessitated a tremendous increase in the water supply facilities of the Washington Aqueduct of which Dalecarlia is a part.

There will be 13 vertical pumping units installed in the new Dalecarlia Pumping Station, having a capacity of 425 million gallons per day. The station, ultimately, will contain 15 pumps having a total installed capacity of 480 mil. gal. per day. The heart of the new station will be the pumping equipment furnished by Worthington Corporation. The equipment will include three 20-in. vertical centrifugal pumps driven by 1,000 h.p., 600 r.p.m. synchronous motors; three 20-in. vertical centrifugal pumps driven by 900 h.p., 900 r.p.m. synchronous motors; four 24-in. vertical centrifugal pumps with 1750 h.p., 900 r.p.m. synchronous motors; and three 30-in. vertical centrifugal pumps driven by 500 h.p., 327 r.p.m. synchronous motors. All synchronous motor drives are furnished by Electric Machinery Co.

The new Dalecarlia Pumping Station is scheduled for completion in January, 1957.

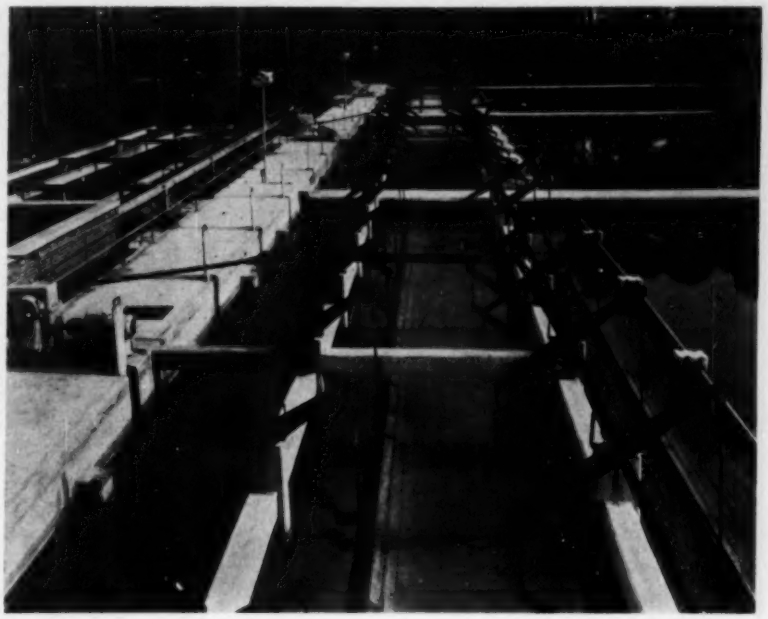
Surface Waters of Kentucky Described in Report

Chemical Character of Surface Waters of Kentucky, 1949-51, is the title of a report by W. L. Lamar and L. B. Laird, 1953, published by the Agricultural and Industrial Development Board of Kentucky, Frankfort, Ky. ($1.00)

This report is the first of a series on a systematic study of the chemical character of the surface waters of Kentucky. Samples were collected at 85 locations; 665 chemical analyses and 4,279 measurements of specific conductance are presented. Tables of water temperatures are given for 37 locations.

The report describes the chemical character of the surface waters of the state, as well as the significance of the chemical and physical properties, giving brief descriptions for 8 river basins. The data on quality of water are valuable for the location and operation of industrial plants, processing and manufacturing of products, selection of sources for public supplies, design and operation of water supply systems, maintenance of wildlife, fish population, and livestock.

Prepared cooperatively by the Agricultural and Industrial Development Board of Kentucky and the U. S. Geological Survey, the report was published by the State Agency.



6 Reasons why

WALKING BEAM FLOCULATION

is now specified by water works engineers

1. **Eliminates troublesome underwater bearings.**
2. **Eliminates expensive dry well construction.**
3. **All bearings accessible for inspection and lubrication.**
4. **Produces quick responsive floc formation.**
5. **Longer filter runs.**
6. **A saving in alum.**

Write today for Bulletin 451 and a list of water purification plants that have gone modern.

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ELECTRIC PHOTOMETER

Adaptable for Use in Water Analysis

Can be used for any determination in which color turbidty can be developed in proportion to substance to be determined.

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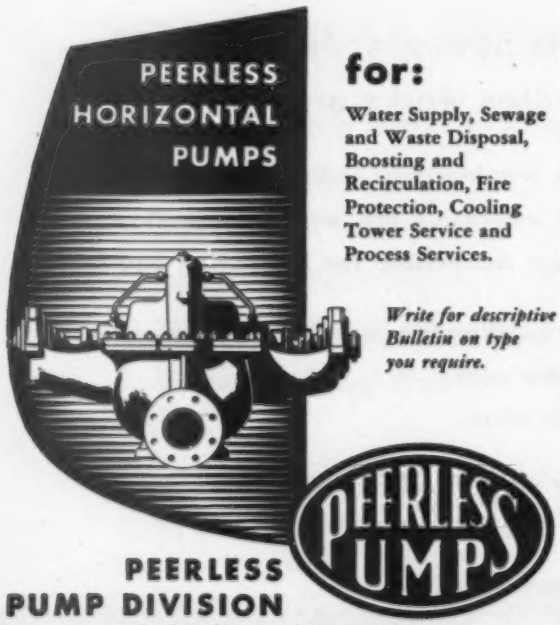

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Food Machinery and Chemical Corp.

Factories: **Los Angeles, Calif.; Indianapolis, Ind.**

Offices: **New York; Chicago; St. Louis; Atlanta; Phoenix; Dallas, Plainview and Lubbock, Texas; Fresno; Los Angeles; Albuquerque; Tulsa.**

PEERLESS BUILDS DEPENDABLE PUMPS

(Continued from page 89A)

Oct. 4-6—Poland Spring, Me. *(Poland Spring House)*
NEW ENGLAND WATER WORKS ASSOCIATION. (73rd Annual Convention). Sec'y Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

Oct. 4-6—Atlantic City, N.J. *(Chalfonte-Haddon Hall)*
PENNSYLVANIA MUNICIPAL AUTHORITIES ASSOCIATION. Sec'y, Claude C. Fogelman, 1717 Main St., Northampton, Pa.

Oct. 6-8—St. Paul, Minn. *(Hotel not selected)*
MINNESOTA SECTION A.W.W.A. Sec'y, Leonard N. Thompson, Gen. Mgr., Water Department, St. Paul, Minn.

Oct. 11-14—Cincinnati O. *(Netherland Plaza Hotel)*
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSOCIATIONS. (27th Annual Convention). Exec. Sec'y, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.
(In conjunction with)
OHIO SEWAGE & INDUSTRIAL WASTES TREATMENT ASSOCIATION. Sec'y, Ward E. Conard, 301 Ohio Departments Bldg., Columbus 15, Ohio.

Oct. 11-15—Buffalo, N.Y. *(Statler Hotel*—Tech. Sessions, *Memorial Auditorium)*
AMERICAN PUBLIC HEALTH ASSOCIATION. (Annual Meeting). Sec'y, Mrs. W. R. Walsh, A.P.H.A., 1790 Broadway, New York, N.Y.

Oct. 13—Brunswick, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Oct. 13-15—Cedar Rapids, Iowa *(Roosevelt Hotel)*
IOWA SECTION A.W.W.A. Sec'y, H. V. Pedersen, Municipal Bldg., Marshalltown, Iowa.

Oct. 17-20—El Paso, Texas *(Cortez Hotel)*
SOUTHWEST SECTION A.W.W.A. Sec'y, Leslie A. Jackson, Robinson Memorial Auditorium, Little Rock, Ark.

Oct. 18-22—New York, N.Y. *(Statler Hotel)*
AMERICAN SOCIETY CIVIL ENGINEERS. (Annual Meeting). Exec. Sec'y, Wm. N. Carey, 33 West 39th St., New York, N.Y.

Oct. 19-22—Atlantic City, N.J. *(Chalfonte Hotel)*
PENNSYLVANIA WATER WORKS ASSOCIATION. Sec'y, David Dunlap, 504 N. Second St., Harrisburg, Pa.

Oct. 24-27—Birmingham, Ala. *(Tutwiler Hotel)*
ALABAMA-MISSISSIPPI SECTION A.W.W.A. Sec'y, Charles W. White, State Department of Health, Montgomery, Ala.

Oct. 26-29—Long Beach, Calif. *(Wilton Hotel)*
CALIFORNIA SECTION A.W.W.A. Sec'y, Henry F. Jerauld, 1040 Manzanita, Pasadena, Calif.

Oct. 27-28—Springfield, Ill.
ILLINOIS WATER WORKS OPERATORS CONFERENCE. Sec'y, Clarence W. Klassen, State Dept. of Health, Springfield, Ill.

Oct. 27-29—Baltimore, Md. *(Hotel not selected)*
CHESAPEAKE SECTION A.W.W.A. Sec'y, Carl Lauter, 6955 33rd St., Washington 5, D.C.

Nov. 3-5—Richmond, Va. *(Jefferson Hotel)*
VIRGINIA SECTION A.W.W.A. Sec'y, J. P. Kavanagh, 915 Colonial-American Bank Bldg., Roanoke 11, Va.

Nov. 4-6—Atlantic City, N.J. *(Madison Hotel)*
NEW JERSEY SECTION A.W.W.A. Sec'y, C. B. Tygert, Box 178, Newark 1, N.J.

Nov. 8-9—Huntington, W. Va. *(Hotel Prichard)*
WEST VIRGINIA SECTION A.W.W.A. Sec'y, Harry K. Gidley, State Dept. of Health, Charleston 5, W. Va.

Nov. 7-10—St. Petersburg, Fla. *(Soreno Hotel)*
FLORIDA SECTION A.W.W.A. Sec'y, Wm. W. Aultman, Box 316, Coconut Grove Sta., Miami 33, Fla.

Nov. 8-10—Asheville, N.C. *(George Vanderbilt Hotel)*
NORTH CAROLINA SECTION A.W.W.A. Sec'y, E. C. Hubbard, P.O. Box 2091, Raleigh, N.C.

Nov. 9-10—Colorado Springs, Colo. *(Broadmoor Hotel)*
ROCKY MOUNTAIN SECTION A.W.W.A. Sec'y, Geo. J. Turre, Box 600, Denver, Colo.

Nov. 11-12—McCook, Neb. *(Keystone Hotel)*
NEBRASKA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Paul W. Mousel, 602 West B Street, McCook, Neb.

A HOMELITE PUMP

is **FIRST** on the job in more ways than one

FIRST to get on the job . . .

FIRST to complete the job.

There is the real action story of Homelite Gasoline Engine Driven Pumps.

They're first to get on the job, because they're small, compact, *carryable* . . . easy to put, by one man, anyplace you need them. Yes, and they're first to complete the job, because of their quick starting, self-priming, 28 foot suction lift, and pumping capacity which ranges from automatically controlled seepage up to 15,000 gallons per hour.

Before buying any other pump, see a Homelite Pump in action.

Write and we'll gladly give a free on-your-job demonstration.

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Carryable Pumps • Generators
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● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

Pickups from Purdue's "Sanitary Engineering News"

Don E. Bloodgood, Editor

The membership of the American Water Works Association was 9460 at the end of 1953.

* * *

The settled effluent from the Moose Jaw, Sask. sewage plant is passed to a reservoir and used by an oil industry for cooling purposes.

* * *

Pilot plant studies at Virginia Polytechnic Institute have successfully produced acetic acid from neutral sulfite blow-down liquor, such as is wasted at paper making plants.

Sea Water Conversion Projects Yield Encouraging Results

Practical methods for large scale conversion of sea water to fresh drinking water are being investigated with encouraging results at the engineering field station of the University of California. The research is to be pushed at both Berkeley and UCLA.

"The experimental results to date indicate that these methods should produce fresh water at attractive prices under conditions which exist in some parts of California," said Everett D. Howe, associate dean of the College of Engineering at Berkeley and director of the Sea Water Demineralization Project at Richmond.

There are two special types of experimental units operating at the Engineering Field Station now, said Dean Howe. These are a solar distiller and a low - temperature - difference combined power plant and still. A third type of experimental unit, a triple-effect distiller using waste heat from a diesel engine, will be operating soon.

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BUILT ON QUALITY SERVICE PRESTIGE
Our manufacturing plant is one of the most modern and best equipped of its kind in the United States, combining quality control with mass production of a complete line of M & H valves, hydrants and accessories.
M & H products have long enjoyed national recognition by engineers and water works management for simplicity of design and superior quality of materials and workmanship. The national prestige of M & H products is founded on two things: (1) some 30 years of experience in engineering, design and shop practice in valve and hydrant manufacturing, plus (2) the service record of M & H products for many years under practical operating conditions in all sections of the country. For details, write or wire M & H VALVE AND FITTINGS COMPANY, ANNISTON, ALABAMA.
M&H PRODUCTS
FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION

Large Multiple Surface Filters

501

Micro Metallic Corporation, Glen Cove, New York, has developed compact, large capacity filters with filter areas up to 720 square feet and cake space capacity up to 35 cubic feet.

Filter medium is high temperature resistant porous stainless steel and container can be either carbon steel or stainless steel for corrosive service.

Compact design permits steam jacketing, high pressure construction, sanitary construction and ease of cleaning.

Porous stainless steel filter medium prevents "break-through" point, or pressure above which clarity of filtrate is no longer obtained and is the perfect support medium for filter-aid, since it will not pass filter-aid during any portion of the filtration cycle.

Hugh Glen Elected President of Johnston Pump

The Johnston Pump Company, Pasadena, Calif., has announced that Mr. Hugh Glen has been elected President of the Company.

Mr. Glen succeeds Mrs. Thomas W. Simmons who has resigned as President, but is still sole owner of the firm. Mr. Glen was formerly President of Emsco Derrick & Equipment Company.

Salem got the "Big 3"

Will your city?

Out here in Ohio, Salem wanted a 20-inch supply line that would *last a 100 years or more,* be *strong enough to be virtually shatter-proof,* and give them *sustained high carrying capacity.*

They picked Price Pipe, because it gave them *every one* of the "Big 3": *long life, great strength* and *sustained capacity.*

Rochester, N. Y. picked Price Pipe for the same reasons. So did Dayton, Ohio, Saginaw, Michigan and many more.

Will your new water line meet all three requirements?

If you want the best pipe today's engineers can design, specify Prestressed Concrete Steel-Cylinder Pipe.

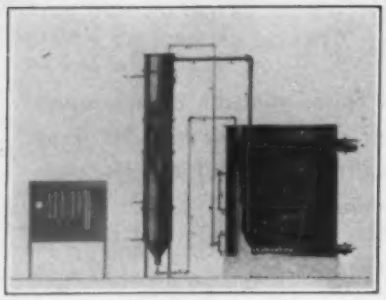
Tell your consulting engineer to check with our engineering department for sizes, weights, tests and laying information.

Price Brothers Company

1813 East Monument Ave. • Dayton 1, Ohio

Concrete Pressure Pipe for Water Supply, Subaqueous, Pressure Sewer and Culvert Installations

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.



New Continuous Water Softener

502

The Dorr Company, Stamford, Conn., has announced the availability of the Dorrco Hydro-Softener for the continuous softening of municipal water supplies. Softening is achieved through the medium of base exchange resin, a portion of which is continually regenerated with brine in a separate column, thus eliminating batch operation. A single Hydro-Softener will remove from 80 to 99% of the hardness in the feed, depending upon raw water characteristics and desired salt efficiency. Even greater reduction is possible by passing the treated water through a second unit.

The Hydro-Softener consists of two elements—a two compartment softening cell and a five compartment resin regeneration cell, both of cylindrical welded steel construction. In addition, panel mounted controls are provided for regulation of resin transfer, brine and wash water flows, and measurement of regenerated resin purity. The two compartments in the softening cell are separated by a perforated diaphragm, and each contains an equal amount of base exchange resin. Steel plates fitted with pipe nipples define the five compartments of the regeneration cell through which resin flows continuously.

Marlow Pumps Opens Texas Plant

Marlow Pumps, Division of Bell & Gossett Company, Ridgewood, New Jersey, has announced the establishment of a new branch manufacturing plant at Longview, Texas, 125 miles east of Dallas.

According to the company, the new plant's location in the rapidly developing industrial center of East Texas, offers vastly improved shipping facilities and will offer even faster service to Marlow's customers. Marlow executives estimate that the average shipping time will be cut some 30% by the move. The company's plant in De Queen, Arkansas, as a result of the improved service afforded by the Longview plant, will be shut down and all operations formerly conducted in De Queen will be transferred to Longview.

The complete Marlow line of engine-driven self-priming and end-suction centrifugal pumps, will be manufactured at the Longview plant. A balanced stock of all type pumps and parts will be maintained and service facilities will be available.

Sales Department Changes at Leeds & Northrup

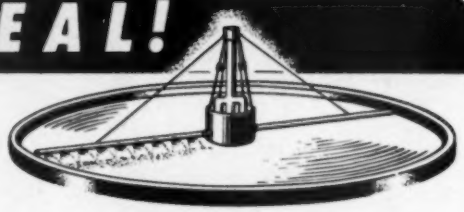
Leeds & Northrup Company, Philadelphia, Pa., has announced the promotion of two sales field engineers to district managerships, a change in territory for another manager, and the opening of a new branch office in Milwaukee, Wis.

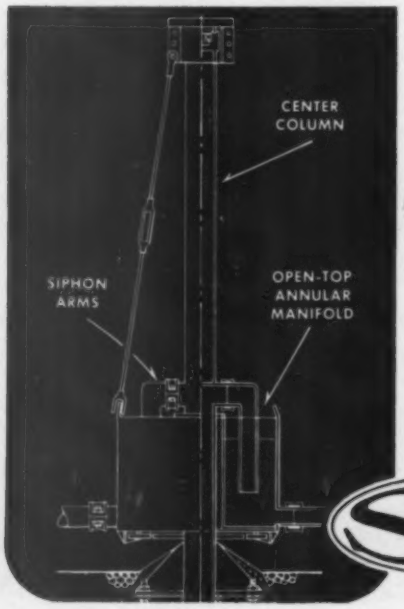
Wilson D. Trueblood, Jr., formerly in the Leeds & Northrup Chicago office, becomes district manager of the new five-man office at 828 North Broadway, Milwaukee.

(*Continued on page* 98A)

WITHOUT A SEAL!

The cross sectional drawing below shows the operating principle of the Smith & Loveless Sy-No-Seal Rotary Distributor. The sewage enters the center column from below and discharges through the siphon arms into the open-top annular manifold which surrounds the center column and is free to rotate around it. Sufficient head is maintained in the manifold to discharge the flow through the orifices along the arms.





Smith and Loveless

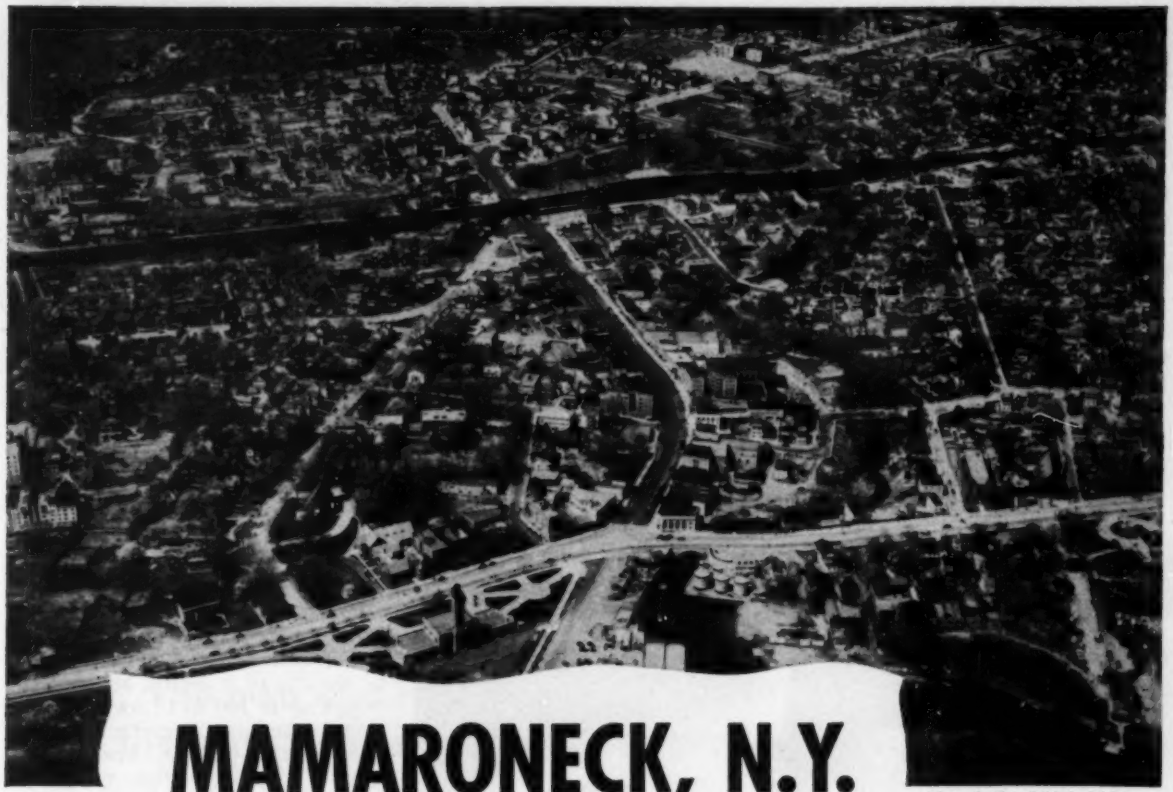
SY-NO-SEAL ROTARY DISTRIBUTOR

The Smith & Loveless Sy-No-Seal Rotary Distributor has no mercury or mechanical seal between the stationary center column and the rotating distribution arms. This revolutionary new design eliminates costly mercury replacements or the binding and wear of mechanical seals caused by grit. The Smith & Loveless Rotary Distributor has a lower initial cost, starts faster, runs faster, gives more uniform distribution and requires less maintenance and service.

For further details and specifications write for Bulletin R-101.

S&L SMITH & LOVELESS, Inc.

P. O. BOX 8172, KANSAS CITY, MO., Plant, MERRIAM, KANSAS



MAMARONECK, N.Y.

Photo by Fairchild Aerial Surveys

CONVERTS 4 FILTERS TO POROUS UNDERDRAINS

Westchester Joint Waterworks #1, serving the Village of Mamaroneck, N. Y., and the Towns of Harrison and Mamaroneck, has four 18′ x 24′ beds, each with a capacity of 1¼ MGD. All were originally built with conventional graded gravel, and pipe laterals with strainers. All have had the usual troubles of mudball formations . . . upset beds . . . loss of filter media . . . corroded strainers . . . and other complications inherent with this system.

However, a gradual modernization program over a period of years, has all but eliminated these problems. Two of these filters have already been converted to our ALOXITE® aluminum oxide plates. Another one is now in the process of being modernized. And the last filter will be changed over to porous underdrains later this year. (Incidentally, the first of these jobs was our seventh installation, and today there are well over 300 in service).

The results, as usual, have been uniformly good. There are no mudballs, and no upset beds. Backwash is complete over the entire bed. And there is no building up of head loss in the system. Superintendent G. H. Straub reports that it is easy to keep filter media clean. Also, that the efficiency of these underdrains has kept operating costs low.

CARBORUNDUM

Registered Trade Mark

Dept. M-54, Refractories Division The Carborundum Co., Perth Amboy, N. J.

Send for our booklet on porous media. All fields of filtration and diffusion covered in 56 pages. No obligation, of course.

(Continued from page 96A)

Trueblood joined Leeds & Northrup in 1924, after graduating from the University of Wisconsin, and for some years has been representing his firm in the area covered by the new office.

Edwin A. Yeo, for sixteen years the firm's Cincinnati manager, becomes manager at Pittsburgh. Mr. Yeo, who joined L & N in 1928, replaces the late Harold S. Vecella, long-time L & N sales executive there.

Willard H. Neu, formerly a sales field engineer in the Leeds & Northrup Pittsburgh office, becomes district manager at Cincinnati. He joined the firm in 1935 after graduating from Johns Hopkins University.

New Chlorinator By Wallace & Tiernan

503 •

Wallace & Tiernan Incorporated, Belleville, N.J. has just announced a new chlorinator, the A-701, which will be introduced at the American Water Works Association Convention in Seattle on May 23.

First of a series that incorporates the latest developments of practical

chlorinator design, the A-701 will feature such improvements as dual orifice meter which automatically, or by the flip of a switch, allows feed ranges up to 100 to 1; corrosion resistant materials wherever good structural design permits; linear scale reading of chlorine flow rate; and automatic electric, hydraulic, air or vacuum control. Maximum capacity of the A-701 will be 1000 lbs. per 24 hrs.

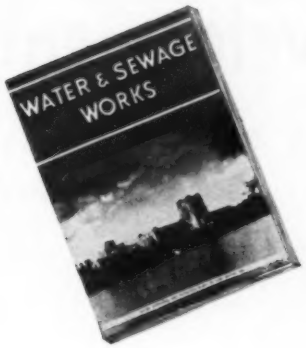
Constructed of the most up-to-date materials, and using the best chlorine feed principles developed over a period of years, the new chlorinator employs a heavy fiberglas pedestal and an improved design of the W&T glass-enclosed visible-vacuum and water-diaphragm principle of feed control.

Pipe Threader for Power Drives

504

Ridge Tool Company, Elyria, Ohio, has developed a Pipe Threader for use on power drives. This new pipe threader is entirely self-contained and can be quickly and easily adjusted to thread 1" to 2" pipe using only one set of dies. The quick-opening handle retracts dies instantly without stopping power drive. Dies can be adjusted without removing the threader from the machine. There is no lead screw to jam or wear out and this threader will fit all standard power drives. Other features of the RIDGID "504" include one set of high-speed steel dies and a pre-set 4-jaw centering guide. It will cut oversize, undersize and extra long threads.

The
FORD
Yokebox
A Better Meter Setting for Shallow Services
A simple, compact meter housing, complete with service valve, for warm climate installations. The modern and better way to install water meters. Gives better protection, keeps meter cleaner. An investment in easier meter reading, longer meter life and greater revenue.
Write for information on the Yokebox.
1. Small lid, clean meter, speeds meter reading.
2. Easy to handle, quickly installed as a unit.
3. Meter changes quick and easy, without cumbersome tools.
4. Service valve easily operated and well protected.
FORD
FOR BETTER WATER SERVICES
THE FORD METER BOX COMPANY, INC. Wabash, Indiana



"Every individual connected with water purification or sewage works should subscribe to this publication. I have introduced it to a host of friends in this field"

Testimonials such as this from subscribers to WATER & SEWAGE WORKS really tell the story. The man who reads and uses the magazine as an aid in his work knows how much it will benefit other workers in the field.

The great REFERENCE & DATA issue alone is worth more than the yearly subscription rate. In it you will find formulae, charts and illustrations covering information not obtainable in any other one source.

Supply of 1953 REFERENCE & DATA number is limited. If you are not a subscriber send your order today!

WATER & SEWAGE WORKS
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Chicago 1, Ill.

You may enter my order for 1 yr. @ $2.00 ☐
☐ Include R&D issue 2 yrs. @ $3.00 ☐
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Send bill to.....
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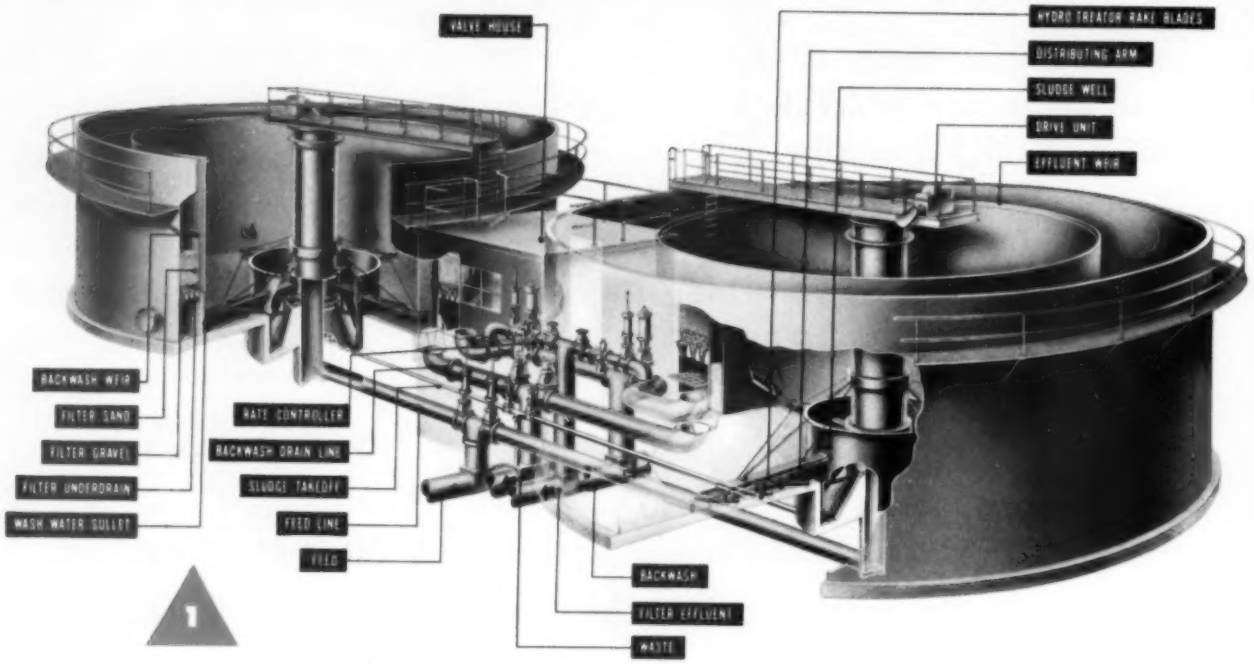
(Add $1.00 per year for foreign postage)

- *If you are interested in the water field only you get all the authoritative data on this subject.*
- *If you are interested in sewage problems only you are kept fully informed and given much help in this field.*
- *If you are interested in both subjects you get all the information in this one monthly magazine.*

3 New DORR Developments

FOR MUNICIPAL AND INDUSTRIAL SANITATION...

These three new Dorr developments are now commercially available to help in the solving of community or industrial sanitation problems. For descriptive Bulletins about this equipment, just return the coupon.



The Dorrco Aldrich PeriFilter System Cuts Filtration Plant Construction Costs up to 40%!

A unique design permits installation of a Dorr pre-treatment mechanism and an annular rapid sand filter in the same welded steel tank... valves and piping are greatly simplified . . . reduced head losses and simple operation add up to lower operating costs. Illustration shows two PeriFilters manifolded together to operate in parallel and with Dorrco Hydro-Treators installed for pre-treatment.

Better tools TODAY to meet tomorrow's demand

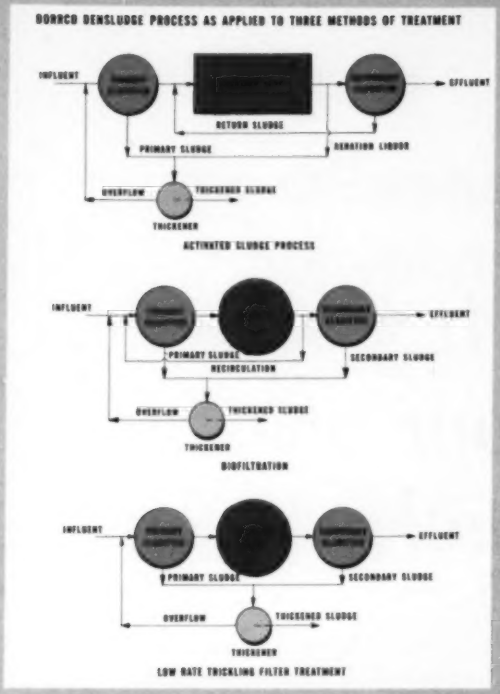
DORRCO

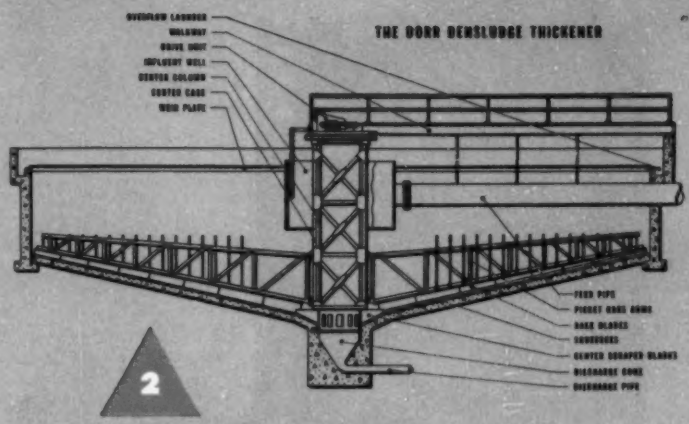
DORR

WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

THE DORR COMPANY • ENGINEERS • STAMFORD, CONN.

Associated Companies and Representatives in the principal cities of the world

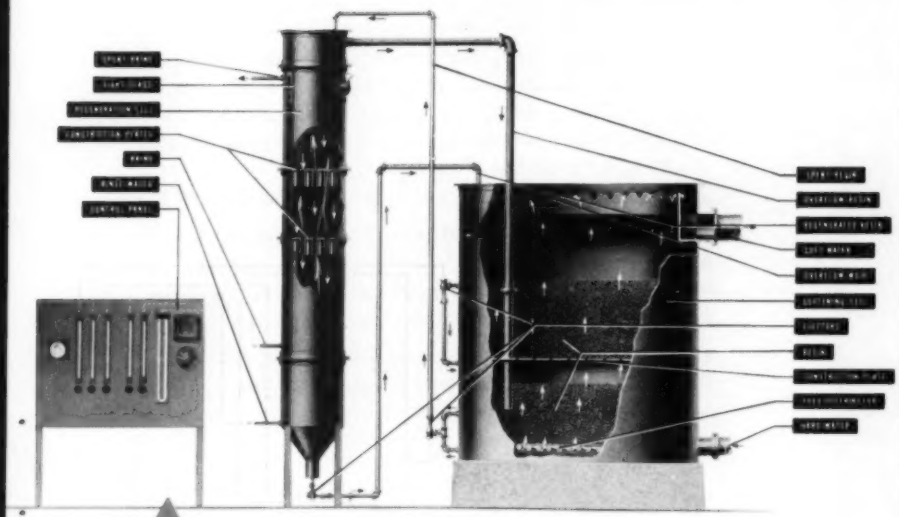




2

The Dorrco Densludge Process Reduces Sewage Sludge Volume up to 50%!

Clarification and thickening are carried out separately so that maximum efficiency is realized in each operation. Dorr Densludge Thickener produces a concentrated sludge greatly reduced in volume which cuts digester requirements, sludge drying bed area and other sludge handling facilities. Process is equally adaptable to new and existing plants employing primary, activated sludge, Biofiltration or low-rate filter flow-sheets.



3 THE DORRCO HYDRO-SOFTENER

The Dorrco Hydro-Softener Continuously Softens Water Supplies by Base Exchange Resins!

For the first time, base or cation exchange softening can be put on a continuous basis. Installed cost is lower than with a conventional batch exchanger, and greater brine and rinse efficiency result in lower operating costs. The Hydro-Softener produces a continuous supply of softened water at a constant quality.

FIFTY YEARS 1904–1954

For information about these new tools and new processes, return the coupon to THE DORR COMPANY, Stamford, Conn. In Canada: 26 St. Clair Avenue, E., Toronto 5.

THE DORR COMPANY
Stamford, Connecticut

Yes, I'm interested in these new developments.
Please send me more information on the items checked . . .

- ☐ THE DORRCO ALDRICH PERIFILTER SYSTEM
- ☐ THE DORRCO DENSLUDGE PROCESS
- ☐ THE DORRCO HYDRO-SOFTENER

Name .....

Title or Occupation .....

Street .....

City ..... P.O. Zone .... State .....

At your age!

If you are over 21 (or under 101) it's none too soon for you to follow the example of our hero, Ed Parmalee, and face the life-saving facts about cancer as presented in our new film "Man Alive!". You'll learn, too, that cancer is not unlike serious engine trouble—it usually gives you a warning:

(1) any sore that does not heal (2) a lump or thickening, in the breast or elsewhere (3) unusual bleeding or discharge (4) any change in a wart or mole (5) persistent indigestion or difficulty in swallowing (6) persistent hoarseness or cough (7) any change in normal bowel habits.
While these may not *always* mean cancer, any one of them should mean a visit to your doctor.
Most cancers are curable but *only* if treated in time!

You and Ed will also learn that until science finds a cure for *all* cancers your best "insurance" is a thorough health examination every year, no matter how well you may feel—twice a year if you are a man over 45 or a woman over 35.

For information on where you can see this film, call us or write to "Cancer" in care of your local Post Office.

American Cancer Society

MAN ALIVE! is the story of Ed Parmalee, whose fear weakens his judgment. He uses denial, sarcasm and anger in a delightful fashion to avoid having his car properly serviced and to avoid going to a doctor to have a symptom checked that may mean cancer. He finally learns what a difference it makes (in his peace of mind and in his disposition) to know how he can best guard himself and his family against death from cancer.

The difference between Life... and Death...

"Why should you give blood? Ask me—I ought to know. I fought in Korea. But since then I've been through the biggest battle of all—the battle for life itself. And it was blood—and blood alone—that saved me. Don't know when I'll be in a position to start repaying my debt by giving some blood of my own. But I will—some day. You can count on it!"

All kinds of people give blood—for all kinds of reasons. But every reason for giving blood is a *special* reason . . . just as every American life that can be saved at any time and at any place . . . is special. So whatever *your* reason for giving blood, this you can be sure of: Whether it goes to a combat area, a local hospital, or for Civil Defense needs—this priceless, painless gift will some day save an American life!

Give Blood Now

CALL YOUR RED CROSS TODAY!

NATIONAL BLOOD PROGRAM

Business Executives!

✓Check These Questions!

If you can answer "yes" to most of them, you—and your company—are doing a needed job for the National Blood Program.

- ☐ Have you given your employees time off to make blood donations?
- ☐ Has your company given any recognition to donors?
- ☐ Do you have a Blood Donor Honor Roll in your company?
- ☐ Have you arranged to have a Bloodmobile make regular visits?
- ☐ Has your management endorsed the local Blood Donor Program?
- ☐ Have you informed employees of your company's plan of co-operation?
- ☐ Was this information given through Plant Bulletin or House Magazine?
- ☐ Have you conducted a Donor Pledge Campaign in your company?
- ☐ Have you set up a list of volunteers so that efficient plans can be made for scheduling donors?

Remember, as long as a *single* pint of blood may mean the difference between life and death for *any* American . . . the need for blood is *urgent!*

how much does it cost to stand pat?

It isn't often that a new development comes along that affects chlorine handling—in fact, not in the past 35 years has there been news as important as this to you and your community.

You may feel it costs you nothing to let new developments in chlorine handling go by the board. *But it costs your community plenty*—in money, in better chlorination and in better, *safer* handling methods.

Ratochlor units in F & P Hatboro plant awaiting inspection and test *with chlorine* under actual operating conditions.

AN ENTIRELY NEW WAY TO CHLORINATE

Not in 35 years has such a completely new, easy operating, dependable and economical chlorinator been made. There are many reasons why this has been so. One of the most important reasons is that suitable materials that could remain inert to corrosion *were not yet invented.* As a result of wartime needs, many new materials are available now that were not in the laboratory stages even ten years ago.

The most positive way to regulate and control chlorine is the diaphragm regulator principle. But until these corrosion resistant materials were invented, a regulator could not be made that lasted against corrosion. The regulator principle is successfully used in the new Fischer & Porter Ratochlor unit, along with such new products as Uscolite, manufactured by U.S. Rubber Co., Kel-F, Hastelloy, Teflon, and such timeless materials as silver and tantalum.

Old fashioned, out-of-date chlorine dispensing equipment uses vulnerable water seals, whereas in the Ratochlor unit, chlorine is always handled in fully enclosed, tightly sealed, corrosion resistant pipes and components. Chlorine losses from old fashioned design lead to increased corrosion, thus to excessive operating costs. Constant service calls add to costs, repeated maintenance charges mean that you still have an old fashioned unit with most original parts replaced. Such costs are cut to the bone with the new Ratochlor chlorinator.

The Fischer & Porter chlorinator was completely engineered to take advantage of all new developments, was then exhaustively tested in the field for five years. Now you can be sure of the finest in chlorination equipment. Even the outside cabinet is so new, of corrosion resistant *fibre-glass,* that it never needs painting, is resilient to withstand blows and vibrations. The Ratochlor unit is superior in every way. It is low in first cost, costs little to maintain.

You owe it to yourself and your community to *know* about this dependable, safe, less costly way of handling chlorine. Complete facts, fully illustrated, will be sent to you if you will request them right now.

EVERY RATOCHLOR IS BACKED WITH AN IRON-CLAD GUARANTEE

You can't go wrong in replacing old fashioned equipment NOW with the F&P Ratochlor chlorinator. Here's why. Fischer & Porter is a major company, leaders in flow control instrumentation. Hundreds of tons of live chlorine are handled daily by F&P Flowrator* meters in the chemical industry. The Ratochlor unit is so superior to any ever offered, so simple in design and control that it is almost entirely free of costly, repeat service calls. Equipment now in daily use in many communities shows that yearly maintenance costs are a fraction of older units.

Fischer & Porter stands four-square back of *every* Ratochlor unit. Before you agree to buy, F & P will install a Ratochlor chlorinator for a thirty day test period. During this time, you can subject this new unit to any kind of test you can make. *You must be fully satisfied.*

And the day you install your first Ratochlor unit, is the first day of a full year during which you must continue to be fully satisfied with it. Even at the end of one year, if you're not fully satisfied, the Ratochlor unit will be taken out and the full cost—every cent of it—will be refunded. You can't lose with the Ratochlor chlorinator.

complete process instrumentation

FISCHER & PORTER CO.

*T.M., F&P CO.

3930 Fischer Road, Hatboro, Penn.

Company owned sales and service branches strategically located throughout the world.

8201

No words needed...

Before ever he speaks a word, he asks your love.
In it begins the security he will need forever.

The whimper when he's hungry, the sigh of peace when he's fed and warm, the cuddle of his sleepy body—all these tell a need that never ends.
The need that none of us outgrows: to be safe and secure in body and heart as long as we live.

The security of our homes is a universal dream. That each of us is free to make secure the lives of those we love, is our peculiar privilege.

As we take care of our own, we also take care of America. Out of the security of each home rises the security of our country.

Your security and your country's begin in *your* home.

Saving for security is easy! Read every word—now! If you've tried to save and failed, chances are it was because you didn't have a *plan*. Well, here's a savings system that really works—the Payroll Savings Plan for investing in United States Savings Bonds.

This is all you do. Go to your company's pay office, choose the amount you want to save—a couple of dollars a payday, or as much as you wish. That money will be set aside for you before you even draw your pay. And automatically invested in Series E Savings Bonds which are turned over to you.

If you can save only $3.75 a week on the Plan, in 9 years and 8 months you will have $2,137.30. If you can save as much as $18.75 a week, 9 years and 8 months will bring you $10,700!

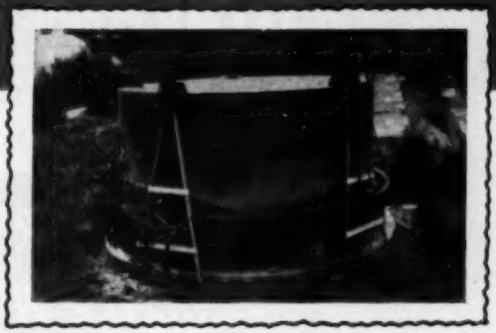
For your sake, and your family's, too, how about signing up today?

WATER & SEWAGE WORKS

"Over 9 years' good protection from corrosion with BITUMASTIC No. 50"

says

C. P. KETLER, Chief Engineer,
Village of Rockville Centre, N.Y.



IN 1942, the Village of Rockville Centre reconditioned the gas holder in its sewage plant. Because the interior was badly scaled and pitted, it was sand blasted, and the surfaces were given two coats of Bitumastic® No. 50—a heavy-duty protective coating that prevents corrosion.

This year, the plant was dismantled as arrangements had been made to have the sewage handled by a Sewage Authority. Mr. Charles P. Ketler, Chief Engineer of Rockville Centre, examined the interior surfaces of the gas holder. Here's what he reported: "Both the protective coating and the gas holder were found to be in excellent condition. We had over 9 years' good protection from corrosion with Bitumastic No. 50."

A good record, particularly when you consider that the interior surfaces were exposed to gas that often produces accelerated corrosion. There are two principal reasons why Bitumastic No. 50 gives such effective protection: 1) Each coat is *extra thick*, equalling 5 to 8 coats of conventional paints, and 2) It has a base of coal-tar pitch that is unaffected by most acids and alkalies.

Besides being used on metal, Bitumastic No. 50 protects concrete and masonry, too. Koppers makes a family of protective coatings, formulated to meet varying conditions. Send for copy of booklet.

SEND FOR FREE BOOKLET!

Our new booklet describes Bitumastic Protective Coatings for sewage plant installations. It will help you select the right protective coating to prevent corrosion and deterioration. It shows how you can protect all sewage-plant equipment, above or underground, metal or concrete. Send for a copy. No obligation, of course.

KOPPERS BITUMASTIC PROTECTIVE COATINGS

SOLD THROUGH INDUSTRIAL DISTRIBUTORS

KOPPERS COMPANY, INC., Tar Products Division, Dept. 561-T, Pittsburgh 19, Pa.
DISTRICT OFFICES: BOSTON, CHICAGO, LOS ANGELES, NEW YORK, PITTSBURGH, AND WOODWARD, ALA.

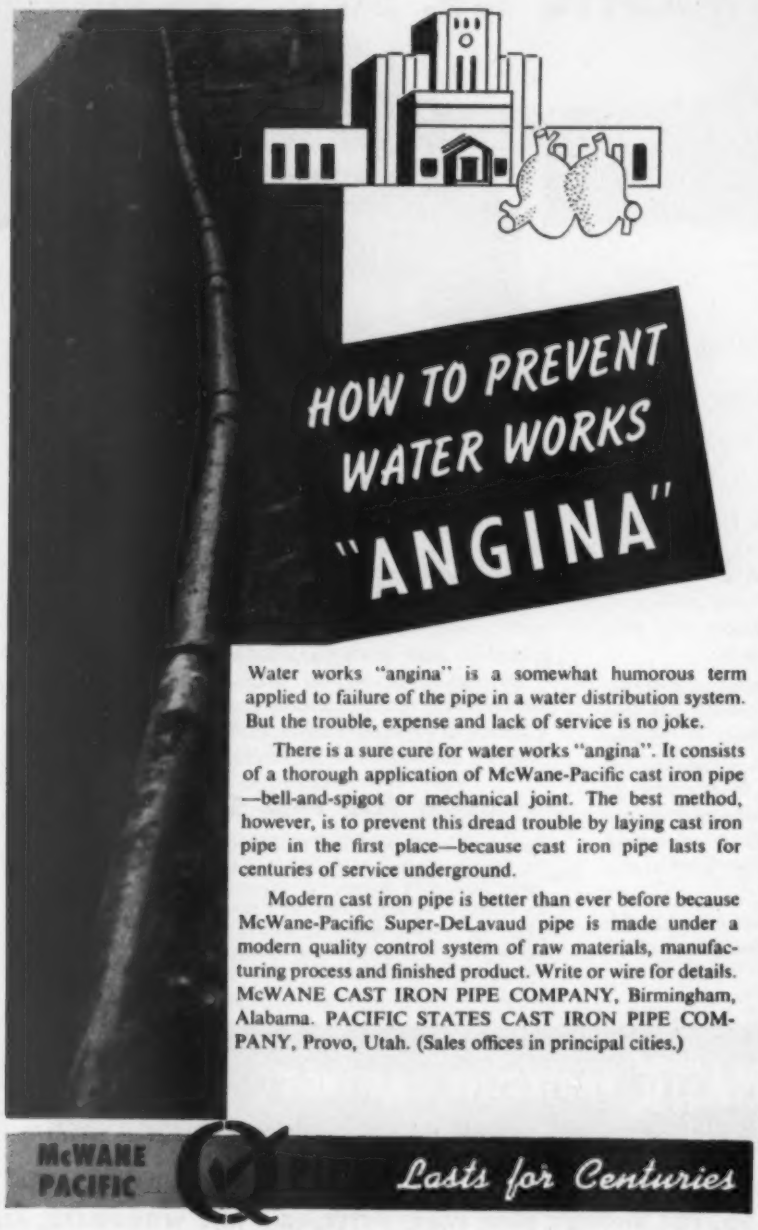
New Directors for Builders-Proportioneers, and Omega

Builders-Providence, Proportioneers, and Omega Machine Co., all Divisions of B-I-F Industries, Inc., Providence, R. I., recently named additional directors to their respective boards.

Elected director of Builders-Providence, Inc. were: John R. Hartley, Vice President of the Division, F. H. Cary, Chief Engineer, R. W. Pearce, Manager of Chlorinizer Sales, Fred W. Deutsch, Manager, Standard and Engineered Products, and Milford E. (Bill) Rogers, Project Engineer.

Roland J. Leveque, Sales Manager of Omega Machine Co., was named a director of that company. George W. Kelsey, Vice President of the parent company, was named a director of Porportioneers, Inc.

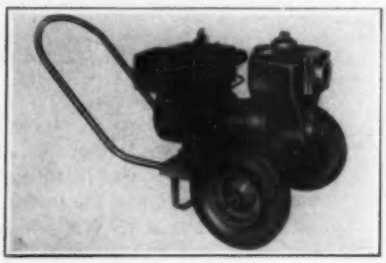
In the parent company, B-I-F Industries, Inc. (formerly Builders Iron Foundry), Z. Chafee retired as Board Chairman and H. S. Chafee, former president, retired as Treasurer and was elected Chairman of the Board. C. V. Raymond is the new Treasurer and Earl H. Bradley continues as President.


HOW TO PREVENT
WATER WORKS
"ANGINA"
Water works "angina" is a somewhat humorous term applied to failure of the pipe in a water distribution system. But the trouble, expense and lack of service is no joke.
There is a sure cure for water works "angina". It consists of a thorough application of McWane-Pacific cast iron pipe —bell-and-spigot or mechanical joint. The best method, however, is to prevent this dread trouble by laying cast iron pipe in the first place—because cast iron pipe lasts for centuries of service underground.
Modern cast iron pipe is better than ever before because McWane-Pacific Super-DeLavaud pipe is made under a modern quality control system of raw materials, manufacturing process and finished product. Write or wire for details. McWANE CAST IRON PIPE COMPANY, Birmingham, Alabama. PACIFIC STATES CAST IRON PIPE COMPANY, Provo, Utah. (Sales offices in principal cities.)
McWANE PACIFIC
Lasts for Centuries

Lachmund Named V.P. of Amercoat

Amercoat Corporation, South Gate, Calif., has announced that Mr. D. O. Lachmund has been named Vice President in charge of sales. Previously, he was Amercoat's Eastern Region Manager, in charge of the company's New Jersey offices for the past five years.

Mr. Lachmund has been affiliated with Amercoat Corporation since 1941. During the past 13 years he has served as Sales Engineer, Advertising Manager, Western Region Manager, and Eastern Region Manager. As Vice President, Mr. Lachmund has left his New Jersey post to join Amercoat's South Gate, California home office where he will direct the firm's national sales activities.



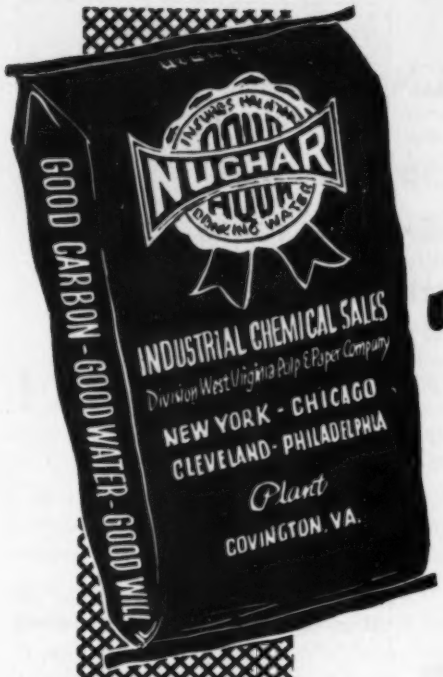
Portable Pumps for Water Drainage

505

Jacuzzi Bros. Inc., Richmond, Calif., has announced completely new and improved line of self-priming contractors'-type centrifugal pumps. Specially built to handle muddy or unclear water, the new heavy-duty units are designed for water drainage or any other application where rapid movement of large volumes of water is desired.

The improved design features a balanced type of priming port which prevents loss of capacity due to recirculation of water. Semi-open impellers are non-clogging with adjustable clearance to compensate for wear; and a special renewable impeller wear plate prevents wear on the

(Continued on page 110A)



a little "Black Magic" goes a long way...

A *small* amount of AQUA NUCHAR—activated carbon—goes a long way toward providing a *great deal* of water that is more agreeable to the senses of taste, smell, and sight. Indeed, AQUA NUCHAR does not rapidly settle to the bottom of the basin, and its "magic" is thus fully utilized in adsorbing objectionable tastes and odors stemming from algae and trade wastes.

Threshold Odor Technicians from INDUSTRIAL will work with you (without obligation) to seek out the most economical means of employing AQUA NUCHAR in your system. These highly trained technicians, *as part of their regular service*, will assist you in the techniques of making an odor survey of your plant. Dosages of AQUA NUCHAR required for consistent production of palatable water will depend upon existing conditions. Likewise, INDUSTRIAL will willingly check the influences of other chemicals used in your process to ascertain the most efficient point of AQUA NUCHAR application.

INSURES PALATABLE AQUA NUCHAR DRINKING WATER

industrial CHEMICAL SALES
division west virginia pulp and paper company

New York Central Bldg.
230 Park Avenue
New York 17, N. Y.

Pure Oil Bldg.
35 E. Wacker Drive
Chicago 1, Ill.

Lincoln-Liberty Bldg.
Broad & Chestnut Sts.
Philadelphia, Pa.

2775 S. Moreland Blvd.,
Cleveland, Ohio

(*Continued from page* 108A)

impeller case itself. Separate opening in top of case permits easy priming without need for extra fittings or disturbance of piping. These pumps are rated for continuous duty as well as for intermittent service.

According to Jacuzzi, the new pumps are now available in a wide range of horsepower ratings with choice of electric motor, gasoline engine or heavy-duty transmission head for belt drive. For greater ease in handling, the pumps may also be ordered complete with a light weight two-wheel hand trailer with ball bearing type wheels and semi-pneumatic tires.

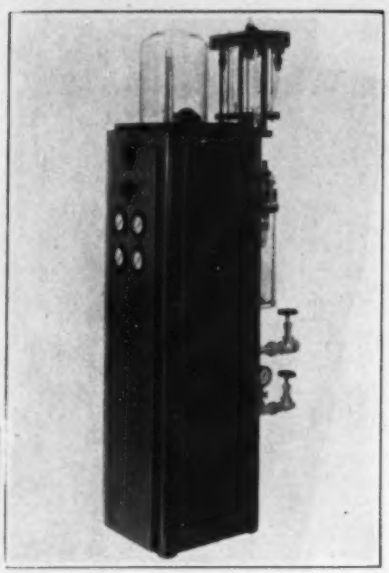
WT Silactor

506

Wallace & Tiernan Incorporated, Belleville, N.J., has developed a compact unit for activating silica with chlorine. The unit, known as the WT Silactor, eliminates the need for auxiliary aging or storage tanks.

Designed to continuously prepare and apply activated silica, the WT Silactor has a maximum of flexibility to fit the requirements of each individual installation.

Chlorine is supplied to the WT Silactor directly from the cylinder in which it is shipped. Sodium silicate



is supplied as it comes from the shipping drum, without intermediate dilution.

The chlorine is controlled and metered by the familiar W&T visible vacuum principle. Sodium silicate is transferred and metered by an accurate volumetric sodium silicate feeder. Water is supplied and metered by a dependable combination of control valves and metering orifices.

All mixing and aging reactions take place in a removable transparent chamber. This chamber is the only portion of the WT Silactor which comes in contact with the concentrated silica sol.

The activated silica is removed from the aging chamber and transferred through a hose line to the point of application by a water operated ejector. The water also serves to dilute and stabilize the activated silica sol.

The complete WT Silactor unit occupies little more floor space than the average office desk.

Motors Easily Adaptable to 1954 NEMA Standards

507

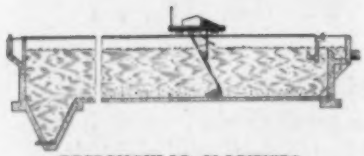
Electric Motor Division of the A. O. Smith Corp, Tipp City, Ohio has announced a new line of integral horsepower motors, designed specifically to provide smooth, economical changeover to the new standards prescribed by the National Electrical Manufacturers Ass'n.

With an engineering program believed to be unique in the industry, A. O. Smith will conform to

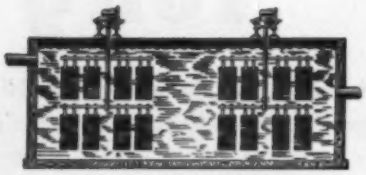
(*Continued on page* 112A)

Hardinge

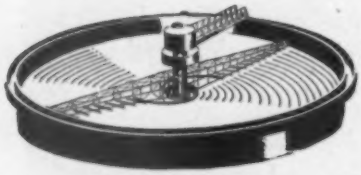
WATER, SEWAGE AND TRADE-WASTE TREATING EQUIPMENT



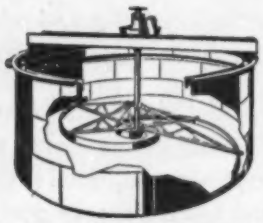
RECTANGULAR CLARIFIERS



FLOCCULATING UNITS

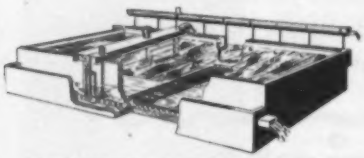


CIRCULAR CLARIFIERS

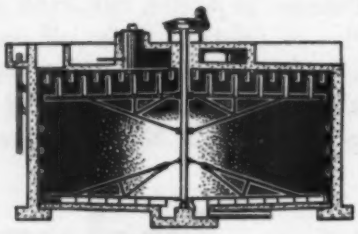


"AUTO-RAISE" THICKENERS

HYDRO-CLASSIFIERS



AUTOMATIC BACKWASH FILTERS



DIGESTERS

Write for Bulletin AH-442-15

HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 Arch St. • Main Office and Works

New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco

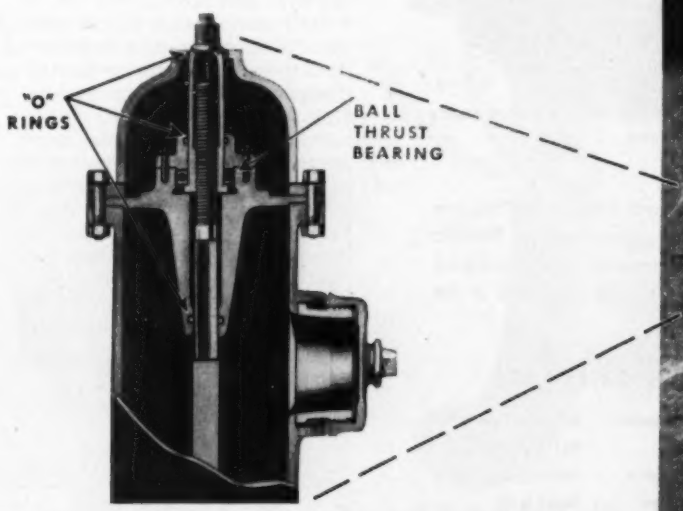
In Cuyahoga Falls...

Darling hydrants for 45 years ...now DARLING B-50-B's are going in!

EASIER maintenance and rugged construction . . . basic design advantages of Darling hydrants and valves . . . have been paying off in Cuyahoga Falls, Ohio, since way back in 1908. In the words of City Engineer T. H. Sauter, "The City of Cuyahoga Falls has been a user of Darling hydrants and valves since 1908. The ease with which repairs can be effected has been a factor in the determination of the city to standardize on this type of equipment."

Darling B-50-B's Bring Unique, New Advantages!

Cuyahoga Falls, and hundreds of other cities too, are now installing the new Darling B-50-B hydrants. This dry-top, ball-bearing hydrant opens quicker, operates easier, and eliminates bothersome packing lubrication. Moreover, the special Darling B-50-B "O" rings are insurance against loss of lubricant for threads and bearings . . . *and never let a drop of water reach the operating threads.*



Before you decide on any hydrant or valve, get all the facts on the new Darling B-50-B hydrant and Darling water valves for every service. *Write today!*

DARLING VALVE & MANUFACTURING CO.
Williamsport 11, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ontario

(*Continued from page* 110A)

the 1954 standards established by NEMA, but at the same time will offer users the new motors in either the present or in new mountings.

This promises to be a matter of considerable saving to the customer, who during the transition period can avoid the cost of remodeling machines and can liquidate inventories of belts, pulleys and accessories without loss.

We can think of only two reasons people don't mind their own business. Either they haven't any mind; or, they haven't any business.

Rutan Joins Neptune Meter

The Neptune Meter Co., New York City, has announced the addition of Mr. Russell E. Rutan, of Clarksburg, W. Va., to its sales force in the states of Maryland, Delaware, Virginia and West Virginia.

He will work with Mr. Michael J. Siebert, Neptune district representative, in calling on municipal and privately operated water works in the four-state area.

Since 1937, Mr. Rutan has been superintendent of the meter department of the Clarksburg, W. Va. Water Board. Previously, Mr. Rutan had been employed for five years by Supervising Engineers, Inc., operating company for the Community Water Service Co., and New Rochelle Water Company. He has also worked for the Commonwealth Water Co., Summit, N.J., the Elizabethtown Consolidated Water Co., Elizabeth, N.J., and the New York State Public Service Commission.

Born in Long Island City, Mr. Rutan was educated in Newark, N.J. schools.

R. H. Holl Joins Logan Clay Products

The Logan Clay Products Co., Logan, Ohio has announced that Richard H. Holl, 24, recently discharged from the U.S. Army after a two-year tour of active duty, has joined the sales department.

Holl, who received his Bachelor of Science degree in industrial Management from Carnegie Tech in 1951, served 18 months as a First Lieutenant in the Corps of Engineers in Korea and Japan.

Holl started with Logan when he was 16 years old as a member of a loading gang. He is the son of the Company's president, Barton A. Holl.

Sewer Joint Packing

508

Presstite Engineering Co., St. Louis, has developed a new nonporous sewer-joint packing, trademarked ROPAX, to provide additional sealing material in the joint.

Ropax is described as especially ideal where adverse soil conditions and excessive ground water are en-

(*Continued on page* 114A)

You can't afford to forget...

That cast iron pipe lasts over 100 years—

That cast iron pipe is inherently stronger, tougher, uniform in quality—

That cast iron pipe offers low installation costs, plus savings throughout its life because of low maintenance costs—

That cast iron pipe's long life and economy saves millions of tax dollars—

That cast iron pipe is the standard conduit for carrying water underground—

That before you experiment with substitutes in your waterworks system, you should study these facts and recognize the guarantee they offer: only cast iron pipe gives you a *proven record* of economy through *decades of use!* And experienced city officials have, for over three-quarters of a century, chosen Clow Cast Iron Pipe as the finest made. They know Clow offers consistent high quality, coupled with excellent service and fast delivery. They know *centrifugally cast* Clow Pipe offers longer life, greater economy and that it meets all currently approved specifications now in existence. Write today for complete, factual information.

JAMES B. CLOW & SONS

201-299 North Talman Avenue • Chicago 80, Illinois

and their National Cast Iron Pipe Division, Birmingham, Ala.
Subsidiaries: Eddy Valve Co., Waterford, N. Y.
Iowa Valve Co., Oskaloosa, Iowa

CAST IRON

(*Continued from page* 112A)

countered and where low infiltration requirements demand tighter, more dependable joints.

Ropax consists of processed fibrous core, completely impregnated and saturated with a blend of selected asphalts containing an inhibitor to prevent the growth of bacteria and fungi. When caulked back in the pipe bell, Ropax forms a solid seal impervious to the passage of water. It is also said to allow for better pipe alignment.

Ropax is comparable in price per pound to ordinary porous packing such as jute. Available in diameters of ⅜", ½", and 1¼", Ropax is furnished on convenient-to-use spools packed in cartons.

Two District Sales Managers Named by Homelite

Homelite Corporation, Port Chester, N.Y., has announced the appointment of R. J. "Ray" Marschalk as Chicago District Sales Manager. In his new position, with headquarters at 2409 Lake Street, Melrose Park, Illinois, Mr. Marschalk will be responsible for the operation of Homelite's Chicago District Sales office and for the supervision of field representatives in Milwaukee, Wis., Bloomfield, Ill., and Melrose Park, Illinois.

Mr. Marschalk comes to Melrose Park from Homelite's San Francisco office where he was District Manager.

At the same time, the company announced the appointment of R. S. "Bob" Kennedy as Manager of Homelite's Melrose Park Branch Office where he will take charge of all local sales in the Chicago area. Mr. Kennedy was formerly Branch Manager at Fresno, California.

Simplex District Manager Appointed

Simplex Valve & Meter Company, Philadelphia, Pa., has announced the appointment of Mr. George L. Walker as the new District Manager of its New York City office. He will assume responsibility for all company sales throughout the New York Metropolitan area, handled by the former W. K. Sowdon Company, New York, N. Y. Mr. Walker's headquarters will be located at 330 West 42nd Street, New York 36, New York.

New Grooved-End, Semi-Steel Valve

509

Rockwell Manufacturing Company, Pittsburgh, Pa., has developed a new grooved-end version of its standard two-bolt yoke type Nordstrom semi-steel lubricated plug valve, making it possible to connect valves to steel pipe with grooved end couplings.

(*Continued on page* 116A)

Pipe Line Equipment
WATER • GAS • SEWER

Bottled Gas Lead Melting Furnace

Asbestos Joint Runners

Best quality asbestos rope, brass caps attached to each end. Equipped with clamps.

M-D Cut-In Connections for Sewers

A light cast iron fitting with bell end for connecting house service with main sewer pipe without necessity for placing a Y-branch or T-branch in the sewer line.

Leak Detector

A truly fine instrument designed to solve even the most difficult leak detecting problem.

Caliking Tool Outfit

For water mains up to 12". Strong leather bag. Keeps the right tool for every job within easy reach.

Test Plugs for Bell or Spigot End Cast Iron Pipe.

On this page are shown only a few of the hundreds of items to be found in the POLLARD Catalog. Write for a copy of Catalog No. 25G.

Portable Lead Melting Furnace

A handy outfit for quick action, equipped with gasoline burner.

Pipe Cutter

Inexpensive way of cutting pipe. Every wheel in contact with the pipe is a cutting disc, so cutter need be moved only a short distance to cut entirely around the pipe.

Tapax

The original manhole cushion. Takes the bang out of manhole covers.

M-Scope Pipe Finder

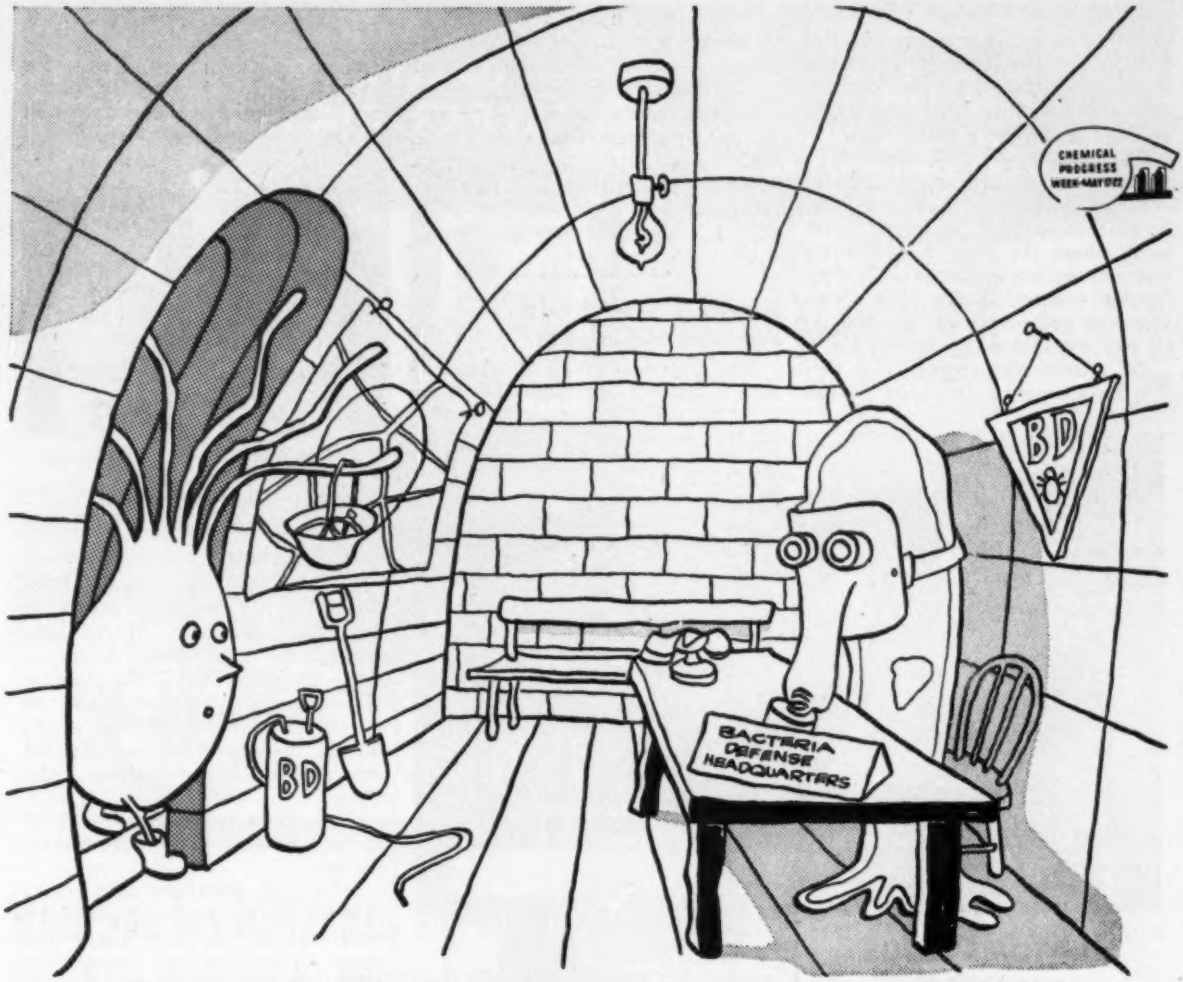
It's easy to locate a buried pipe line with this handy pipe finder.

JOSEPH G. POLLARD CO., INC.

Western Office
1064 Peoples Gas Bldg.
Chicago, Ill.

MAIN OFFICE AND FACTORY
New Hyde Park, N. Y.

Southern Office
333 Candler Bldg.
Atlanta, Ga.



"It's even worse than the atom bomb, Orgie— they're treating the water with **PITTCHLOR®** *"*

Better sound the alarm to scram, Orgie, because you can't win against Pittchlor. Pittchlor is sure and sudden death to chlorine-susceptible bacteria and algae.

A high-test calcium hypochlorite containing a minimum of 70% available chlorine, Pittchlor works fast and effectively in chlorinating water supplies, treating sewage, or wherever else the germicidal and deodorizing action of chlorine is needed.

Pittchlor is dry, white and free-flowing. Its granular form permits ease of application either manually or by mechanical feeders. Write for free folder.

FOR
WATER PURIFICATION
SEWAGE TREATMENT
SWIMMING POOL
SANITATION

Stocked by leading jobbers in 5 lb. resealable cans (9 per case), 3¾ lb. cans (12 per case) and 100 lb. and 130 lb. drums.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
ONE GATEWAY CENTER · PITTSBURGH 22 · PENNSYLVANIA

DISTRICT OFFICES: CINCINNATI • CHARLOTTE CHICAGO • CLEVELAND • BOSTON • NEW YORK • ST. LOUIS • MINNEAPOLIS • NEW ORLEANS • DALLAS • HOUSTON • PITTSBURGH PHILADELPHIA • SAN FRANCISCO

(*Continued from page* 114A)

According to the company with this method, a tight, permanent connection can be made in a matter of minutes and lines may be dismantled as often as necessary without damage to the pipe or grooved end couplings.

This method also eliminates the need for level ditching because a deflection of several degrees at every joint allows the lines to follow the uneven contours of the ground. This flexible connection also offsets pipe vibration and overcomes the problem of pipe expansion and contraction.

In waterworks engineering, they are recommended for water mains and hydrants, high pressure force mains, sewage disposal lines, pumping station connections and viaduct and bridge crossing lines.

The new valve is wrench-operated and has a pressure rating of 175 p.s.i., WOG.

It is produced in 2-in., 2½-in., 3-in., and 4-in. sizes, weighing 14½, 22½, 35 and 55½ pounds, respectively.

American Well Works Appoints McCullough

The American Well Works, Aurora, Illinois, has announced the appointment of S. H. McCullough, 820 Chelsea Avenue, Memphis, Tennessee as Sales Representative for the states of Arkansas, Louisiana and Mississippi and the western half of Tennessee and Kentucky.

M. D. Gilbert

C. K. Madison

Rockwell Awards Service Buttons at Midwest Sales Meeting

Rockwell Manufacturing Co., Pittsburgh, Pa., has announced that M. D. Gilbert, Kansas City district sales manager of the Company's Meter and Valve Division, and C. K. Madison, Midwest regional sales manager, received 30-year and 25-year service buttons, respectively, at a recent Midwest regional sales meeting at Tulsa, Okla.

The pins were presented by P. C. Kreuch, assistant to the vice-president —sales.

Miss Ruth Hickman, sales correspondent in the regional office, was awarded a 25-year pin in a later ceremony. At the same time, George West and Warner Shane, Tulsa district repairmen, received 15- and 10-year service buttons, respectively.

Those who received 20-year buttons at the recent meeting included R. R. Bush, Tulsa district manager; H. M. Logan, sales engineer in the Tulsa district; and W. R. McLaughlin, supervisor of the Dallas, Texas, office.

Fifteen-year buttons: T. I. Stacy, sales engineer, and A. E. Hugel, office manager, both of Houston; J. W. Whiteside, office manager, and C. T. Guffey, sales engineer, of Kansas City.

Ten-year button: R. B. Rugeley, supervisor of the Houston office.

Sales Department Changes at U.S. Pipe

United States Pipe and Foundry Co., Birmingham, Alabama has announced the following changes in the sales department of the Company:

U. S. Pipe's agency agreement with the Water Works Supply Company at Los Angeles, California has been

(*Continued on page* 118A)

"DIATOMACEOUS FILTRATION MERITS SERIOUS CONSIDERATION"

In the February 1954 issue of the Journal of American Water Works Association, Mr. J. K. Fraser (Civ. Engr., Barker & Wheeler, Engrs., Albany, N. Y.) states "Where intermittent filtration must be provided and where the water is of a character that lends itself to filtration by diatomaceous earth, such a process MERITS SERIOUS CONSIDERATION."

The photo shows a diatomaceous earth filtration system installed at Tupper Lake, N. Y. In his article, Mr. Fraser tells why this 1.75 MGD system was selected in preference to a sand filter system. He also speaks about the flexibility of the system — about its quick starting characteristics — about its ease of backwashing and economy of operation.

We will be happy to send you a copy of Mr. Fraser's article "Diatomaceous-Earth Filtration in New York State" — also Bulletin 1800 describing Proportioneers Purecel Diatomite Filtration Systems. Proportioneers, Inc., 350 Harris Ave., Providence 1, R. I. Technical service representatives in principal cities of the United States, Canada, Mexico and foreign countries.

Talk with us about diatomaceous filtration at the AWWA Convention.

PROPORTIONEERS

DIVISION OF B-I-F INDUSTRIES, INC.

BUILDERS IRON FOUNDRY • OMEGA MACHINE CO. • BUILDERS-PROVIDENCE, INC.

METERS FEEDERS CONTROLS

When you buy HYDRANTS and VALVES for your city waterworks system...

LOOK TO THE YEARS AHEAD, TOO!

EDDY can supply replacement parts for any Eddy Valve or Hydrant ever installed! This is important to you because the Valves and Hydrants you buy today must serve several generations yet unborn. You want no "orphans" in your system. Eddy Hydrants and Eddy Valves are backed by Eddy Valve Company's 104 years of dependable operation—your assurance that replacement parts will be available during the years to come.

EDDY Bronze-Mounted HYDRANTS

are built for dependability and lasting service. They open smoothly *with* the pressure and close without water hammer. One man can easily remove all operating mechanism for inspection and repair. Positive drip action automatically drains the standpipe, safeguarding against freeze-ups. Stem held fn place below main valve means no water loss due to a bent stem.

EDDY Bronze-Mounted GATE VALVES

offer simplicity of design, trouble-free operation and enduring service. From the engineering drawing boards through all stages of manufacture, they are step by step a truly "finished" product of workmanship. These factors, added to personal experience, are reasons why progressive water works men have relied on Eddy Valves for years.

Eddy Hydrants and Valves are available with bell, flange or mechanical joint connections to fit any existing or planned installation.

Send today for full information on the complete line of Eddy Valves and Hydrants. No obligation.

EDDY VALVE COMPANY

A Subsidiary of James B. Clow & Sons

WATERFORD, NEW YORK

(*Continued from page* 116A)

terminated and a direct company office established at the same address. George J. Bogs, formerly of the Chicago Office, has been made Los Angeles Sales Agent in charge of this office. Foster T. Manock, who has for some years been associated with this office of Water Works Supply Company, continues in the office as a sales representative for U. S. Pipe.

Late last year, U. S. Pipe's agency agreement with the Hugh Purcell Company at Seattle, Washington, was terminated and a direct company office established at the same address. This office has been placed in charge of Robert N. Park who was made Northwestern Sales Agent. Mr. Park had been associated with the Hugh Purcell Company for a number of years.

A new U. S. Pipe sales office has been opened at Syracuse, New York. The office located at 317 State Tower Building has been placed in charge of J. Perry Emerson, who was made New York State Sales Agent. Previously, Mr. Emerson had been a sales representative in the Eastern Sales Office. The territory served by this office is all of the State of New York except Rockland and Westchester Counties, New York City and Long Island.

It was also announced that Buddy Amis was appointed sales representative at the Houston, Texas office succeeding Richard Clark who left the employ of the Company. Previously, Mr. Amis had been associated with the Dallas Office.

L. C. Krusen, presently in the Eastern Sales Office, Burlington, N.J., will replace Mr. Bogs in the Chicago Office.

I LIKE A FOOLPROOF DESIGN— GIVE ME MATHEWS
AND DON'T FORGET YOU CAN REPLACE A BROKEN MATHEWS WITH A NEW BARREL IN A FEW MINUTES
MATHEWS ARE TOPS FOR EFFICIENCY IN SERVICE
M
M
FD

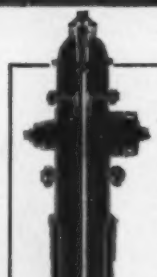
MATHEWS Means Dependable Hydrants

LONG LIFE. Mathews Hydrants have bronze parts at critical points—corrosion, rust and wear are thoroughly licked.

TROUBLE-FREE. The stuffing box plate, cast integral with the nozzle section, provides a positively leak-proof construction — water, sediment and ice cannot interfere with operating thread.

LOW-COST MAINTENANCE. Only one point requires lubrication—and that only during routine inspections.

REPLACEABILITY. A Mathews leveled in an accident can be replaced without excavating and in a jiffy. Community fire protection is interrupted only for a few minutes.



The Mathews includes every quality feature . . .

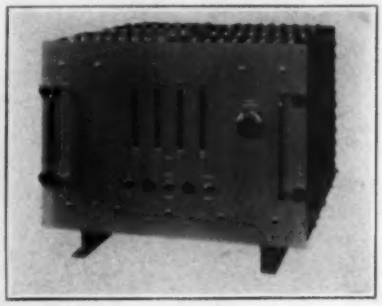
Compression type valve to prevent flooding • Head turns 360° simply by loosening bolts • Replaceable head • Nozzle sections easily changed • Nozzle level can be raised or lowered without excavation • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • A modern barrel makes an old Mathews good as new • Mechanical-joint pipe connections as needed

MATHEWS HYDRANTS

Made by R. D. Wood Company

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves



New Sonic Liquid Level Indicator System

510

Bogue Electric Manufacturing Company, Paterson, N.J. has developed a new liquid level indicator system, Model SL-102, using ultrasonic pulse ranging technique.

This new system, which uses no moving parts such as floats, synchros, potentiometers and switches, has been designed to accurately indicate true liquid levels in processing and storage tanks within 0.01 foot.

A direct level reading in tens, units, tenths and hundredths of a foot is presented on illuminated decimal counters. Level readings are always correct due to the action of an automatic calibration system that compensates for any changes in the velocity of sound propagation which may be caused by varying temperatures, specific gravities and similar differences between liquids being gauged. This compensatory system is self-contained and does not depend upon external sensing elements of any kind.

On common indicator can gauge any number of transducer-equipped tanks within a radius of 2,000 feet. By using a remotely operated rotary coaxial cable tank switching relay developed especially for this application, a large tank farm may be gauged at a minimum of cost. The indicator can also feed level data to standard digital tape printers for use in automatic inventory and accounting systems.

Question:

Can we get installation savings and performance too?

Answer:

Yes...with the new Ring-Tite Coupling

On this Utah job, snow, ice and difficult conditions caused no installation slowdown.

In this California installation, flexible Ring-Tite joints permitted easy conformance to curves.

Speeds assembly of Transite Pressure Pipe

In state after state, contractors are learning that Transite® Pressure Pipe and the new Ring-Tite® Coupling provide fast, sure pipe line assembly with tight, dependable joints . . . strength to assure lasting, trouble-free water mains through the years.

With Ring-Tite, installation costs less—assembly follows digger closely. Typical contractors' comments: "On entire job, trencher and backfiller seldom over 150 feet apart . . ." "Laid 6" Class 150 Ring-Tite at a rate of 5000 feet per 8 hours."

The design of the Ring-Tite Coupling permits quick, easy alignment. To assemble, rubber rings are simply popped into grooves. Then lubricated pipe ends slide in under rings smoothly, easily and surely.

Pipe ends stop positively—with ends automatically separated within coupling. This separation gives the line flexibility to withstand shock and vibration, relieves line stresses, permits conformance to curves. Installations can be completed under adverse weather, temperature or terrain conditions. No complicated equipment is required.

Transite Pressure Pipe and the Ring-Tite Coupling are made of asbestos and cement. Strong and durable, they cannot rust; are highly resistant to corrosion. Tested to A.W.W.A. specifications.

For the new Ring-Tite folder TR-142A—please write to Johns-Manville, Box 60, New York 16, N. Y.

(See us at Seattle—Booths 70-72 A.W.W.A. Convention)

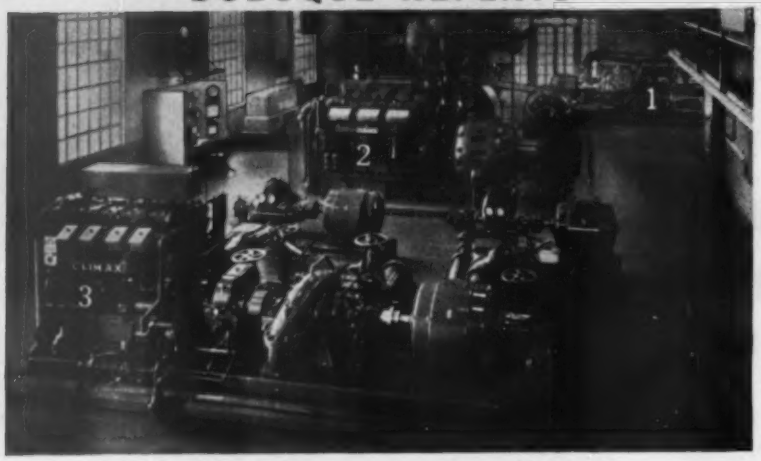
JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE PRESSURE PIPE

NOW WITH THE RING-TITE COUPLING

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

DUBUQUE REPEATS



A satisfied customer is worth more than money in the bank—We have thousands of them—The City of Dubuque, Iowa is an outstanding example.

1. INSTALLED 1939. Climax 8 cylinder gasoline engine direct connected to a 1200 R.P.M. high lift pump normally driven from the other end by a 200 H.P. synchronous motor.

2. INSTALLED 1949. Climax 12 cylinder V-type engine direct connected to a 625 KVA, 2300 volt, 1200 R.P.M. generator for starting and operating large motor driven pumps.

3. INSTALLED 1952. Climax 8 cylinder V-type engine connected through a speed increaser and free wheeling coupling to a 2400 GPM, 260 TDH, 1800 R.P.M. pump normally driven from the other end by a 200 H.P. synchronous motor. During emergencies the engine can operate the pump at rated capacity against a TDH of 350 ft.

We appreciate the confidence of the City of Dubuque and J. J. Hail, The Water Department Superintendent, and are proud of the fact that the performance of Climax engines has justified their repeat orders.

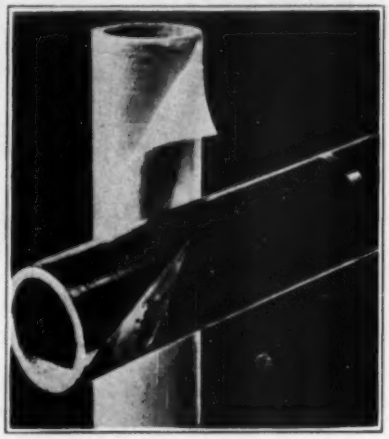
climax

ENGINE AND PUMP MFG. CO.
208 So. La Salle St.
CHICAGO 4, ILLINOIS
Factory–Clinton, Ia. *District Office*–Dallas, Tex.

Executive Elections at Fairbanks Morse

Fairbanks, Morse & Co., Chicago, Ill., has announced that at a recent stockholder meeting O. S. Leslie, Vice President in charge of Manufacturing, was elected to the Board of Directors.

At the subsequent meeting of the Board of Directors, J. A. Cuneo who has for the past several years been General Sales Manager of the company, was elected Vice President in charge of Sales, and Robert B. Craig, formerly Assistant to the President, was elected a Vice President with his headquarters in Washington, D. C.



Low Temperature Pipe Insulation

511

Owens-Corning Fiberglas Corporation, Toledo, Ohio, has announced a low pressure pipe insulation for economical and efficient use on cold water, hot water or low pressure steam lines.

Due to its extra heat-stopping value, a ½-inch thickness of the new pipe insulation equals the performance of ¾-inch to 1-inch thicknesses of many other materials commonly used in the low pressure field.

Fine fibers of glass of which the pipe insulation is composed afford pleasant handling and provide high thermal efficiency.

The insulation is available with a canvas covering for installation on hot water or low pressure lines and with a black jacket of asphalt saturated kraft paper to protect against condensation on cold water lines.

Fiberglas low temperature pipe insulation will stand up under long service because the inert fibers of glass will not rot or corrode. Prolonged accelerated weathering tests indicate no break down of the fibers or loss of efficiency due to aging.

ANTHRAFILT
Trade Mark Reg. U. S. Patent Office
A Filter Medium For All Purposes

ANTHRACITE EQUIPMENT CORP.
Anthracite Institute Building
Wilkes-Barre, Pa.

All correspondence regarding sales and engineering should be addressed to:

PALMER FILTER EQUIPMENT CO.
822 E. 8th St. Erie, Pa.
Engineers and Sales Agents

INSPECTION
REPAIRING
PAINTING

Elevated Tanks and Standpipes

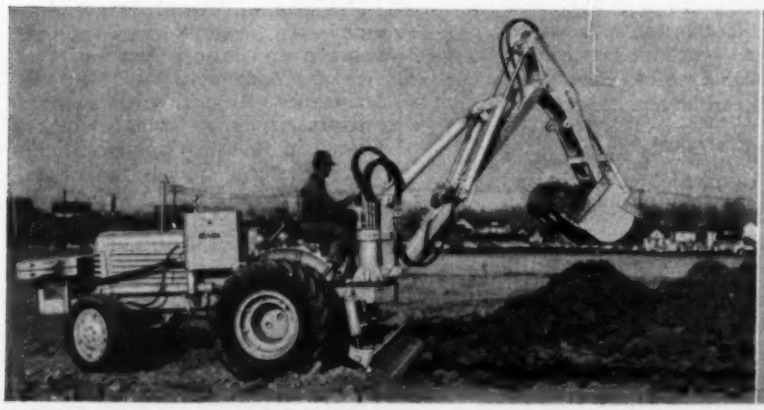
VIRGINIA ERECTION COMPANY
Constitution Blvd.
P.O. Box 387 Rochester, Pa.

Hydro-Trencher puts the squeeze on tough soil!

Working in conditions like this won't slow down the Oliver 88WT Hydro-Trencher. It digs through rocky soil, roots or hard clay fast and clean. Hydraulic down pressure does all the work. The bucket is *forced* full in the toughest going. Two completely separate hydraulic circuits keep pressure on every maneuver, even when you perform two operations at once. You've got working power all the way—to speed your work, to boost your production.

A one-man rig, the 88WT is ready to work or move in a moment. Its half-yard capacity and rubber-tired mobility cut hours and dollars from any job. Its compact design and delicate hydraulic control let you work next to pipes, walls, foundations, without fear of damage. The rugged, hydraulic stabilizer blade holds the unit level and steady, and also doubles as a backfiller blade. And here's a bonus feature, turn the trenching bucket around, in minutes you have a swing loader with all the power features of the trencher.

For more profit, put the squeeze on your trenching or loading operations with the Oliver 88WT Hydro-Trencher. Visit your Oliver Industrial Distributor for a demonstration.



OPERATING FEATURES
OLIVER 88WT HYDRO-TRENCHER
AND SWING LOADER COMBINATION

* One-half yard bucket
* Digs to 10 feet (12 feet with optional boom cylinder)
* Loads to 10½ feet (12 feet with optional loading bucket)
* 200° boom swing

THE OLIVER CORPORATION

400 West Madison Street, Chicago 6, Illinois

a complete line of industrial wheel and crawler tractors

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

Maintained Accuracy...over wide capacity range
Accuracy not affected by pulsations, pressures or other variables
Compact design... to save space and foundation costs
Long-time reliability with little maintenance

CHECK THE "BIG 4"

ESSENTIALS FOR METER PERFORMANCE

The basic accuracy of Roots-Connersville Positive Displacement Meters stems from their simple design, with no valves, vanes or other small parts. And, because there is nothing to wear out, this accuracy is maintained for many years—with little maintenance or other supervision.

Where space is a factor, the compactness of R-C units is important. Capacity of 1,000,000 cfh, for instance, requires only 98 feet of floor area. Small meters can be tucked away in otherwise unusable space. Short-time overloads up to 50% of capacity can be handled without loss of accuracy.

These outstanding values in R-C Meters come from a century of building equipment to handle gas or air, and have been long proved in large and small installations for industry and public utilities.

For detailed information, ask for Bulletin M-152, which also contains a handy selection table to simplify selection of size and type required.

CENTENNIAL 1854 1954

ROOTS-CONNERSVILLE BLOWER

Reg. U.S. Pat. Off.

A DIVISION OF DRESSER INDUSTRIES, INC.
554 Mount Ave. • Connersville, Indiana

BLOWER BUILDERS SINCE 1854

Specialists in handling gas and air

Link-Belt Appoints District Managers

Link-Belt Company, Chicago, Ill., has announced the appointment of John D. Riley as district manager of its Cleveland, Ohio office and Harry G. Andersen as district manager of the Newark, N.J., office.

Mr. Riley, who has been district manager at Link-Belt's Newark office for the past five years, succeeds Paul Wheeler, who passed away January 20, 1954.

Mr. Riley joined Link-Belt in 1934 and for five years successfully served in various departments of the company's Philadelphia plant. In 1939 he was transferred to the Boston office as district sales engineer and, later, became district manager at Newark. He attended Wharton School of the University of Pennsylvania, majoring in business administration.

Mr. Anderson, new district manager at Newark, has been Link-Belt's district manager at Birmingham, Ala., for the past three years. He started with the company in 1937 at the Pershing Road plant in Chicago, where he served in various capacities in the enginering department and Chicago district sales office. In 1948 he was transferred to the Milwaukee office to serve as district sales engineer. He has been at Birmingham since 1951. Mr. Andersen attended Northwestern University, Illinois Institute of Technology and the University of Wisconsin.

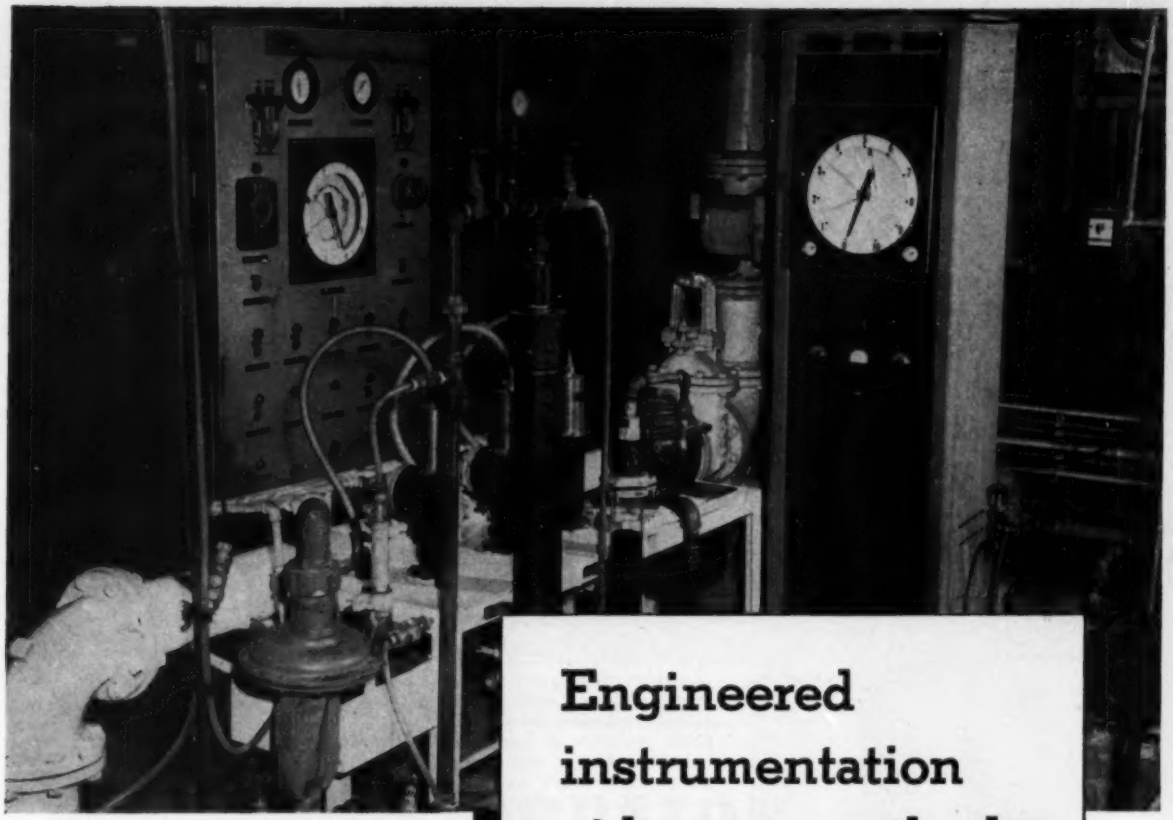
Mueller Announces Three New Sales Managers and Eight New Representatives

Mueller Co., Decatur, Illinois, has announced the following appointments in its sales organization.

Sales Managers: Mr. W. R. Augustine as Central Sales Manager will cover Indiana, Ohio, Kentucky, Wisconsin, West Virginia, Michigan, Western Pennsylvania and Western Virginia; Mr. A. D. Parks as Southeast Sales Manager whose territory includes North and South Carolina, Alabama, Tennessee, Georgia, Florida, Maryland, Eastern Virginia, Delaware, Southern Pennsylvania and most of Mississippi; and Mr. Dan R. Gannon, who as Southwest Sales Manager will cover Texas, Oklahoma, Arkansas, Louisiana and part of Mississippi.

Representatives: Mr. Floyd V. Johnson in the states of Kentucky and Tennessee; Mr. Robert J. Cope in Kentucky, West Virginia, a portion of Maryland and Western Vir-

(Continued on page 124A)



Engineered instrumentation aids new methods of waste treatment

INSTRUMENTATION used by General American Transportation Corporation is an excellent example of the modern trend toward fully automatic, continuous treatment of industrial wastes. Applied to the treatment of phenol and oil bearing wastes from tank car cleaning, this equipment affords pin-point accuracy capable of detecting phenol concentrations as small as 0.001 part per million.

In the installation pictured above, an *ElectroniK* pH Controller on the panel at left regulates the addition of either lime or acid to adjust pH of the effluent from the car cleaning shop. At the right is the phenol control panel, where an *ElectroniK* instrument with *Air-O-Line* control regulates the flow of oxidant in proportion to phenol concentration. The sensing element for this latter instrument is a continuous sampling optical detection system.

ElectroniK instruments analyze chemical concentration, make a permanent record of effluent characteristics, and automatically adjust the addition of reagents. By utilizing their precision and versatility in modern treatment systems, hundreds of plants are reducing the cost of laboratory analysis . . . cutting labor requirements . . . saving chemicals. Your nearby Honeywell sales engineer will be glad to discuss specific applications with you and your consulting engineer. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.

● **REFERENCE DATA: Write for Bulletin 7302, "Instrumentation for Water, Sewage and Industrial Waste Treatment."**

MINNEAPOLIS **Honeywell**

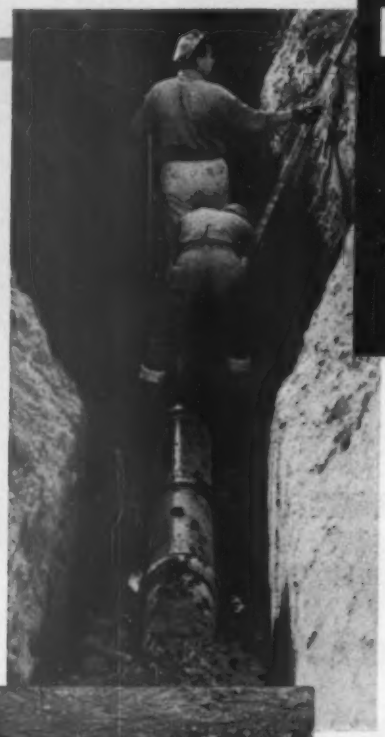
BROWN INSTRUMENTS

First in Controls

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

Ground Water Infiltration Gets the **1-2-3 PUNCH!** *with*

PRESSTITE'S Cold Applied 3-STEP SEWER SEALING SYSTEM



To knock out excessive ground water infiltration and protect against overloading the disposal plant, engineers at Lawrence, Ind., wanted tight, dependable sewer joints. That's why they specified Presstite's 3-Step Sewer Sealing System for 18 miles of new sewer lines serving 2000 homes.

Presstite's extensive research plus 30 years' manufacturing experience have resulted in development of the most effective, economical method to obtain tighter sewer joints:

1. Presstite Primer... a hard base asphaltic priming paint to first prime pipe bells and spigots.
2. Presstite ROPAX . . . non-porous packing that provides *additional* joint sealing material. When caulked back in the bell, it forms a solid seal, impervious to passage of water.
3. Presstite KALKTITE... cold mixed and applied joint sealing compound that sets up even under the most adverse conditions and forms a dense, tough and flexible seal that *stays* watertight.

Sealing tight, dependable joints with Primer, Ropax and Kalktite on Lawrence job.

For substantial savings in time and labor, too, you can't beat the Presstite System. Its fast, easy application allows installation of more joints per man, per hour, per day.

PRESSTITE Sealing Compounds

WRITE TODAY for samples and complete details on Presstite's cold applied 3-Step System for tighter, better sewer joints.

PRESSTITE ENGINEERING COMPANY

3780 Chouteau Ave. St. Louis 10, Missouri

(*Continued from page* 122A)

ginia; Mr. Robert H. Gamble in Eastern Michigan; Mr. Richard C. Sponsler in Delaware, Maryland, Southern Pennsylvania, Eastern Virginia and Washington, D.C.; Mr. Ray E. DeWeese in the Tennessee territory; Mr. Francis X. Uhl in Western Pennsylvania; Mr. Robert B. Herrin in Missouri; and Mr. G. A. Smith in the Southern three-fourths of Illinois.

Pipe and Fittings for Chlorine Handling

512

The Colonial Plastics Mfg. Co., Cleveland, Ohio has announced the development of pipe fittings made of Van-Cor 2 material for handling chlorine in filtration and sewage disposal plants.

The pipe is supplied in 10′ and 20′ lengths and is threaded with standard pipe dies. The ½ inch through the 2 inch fittings are molded and above 2 inches all fittings are flanged.

According to the company, the material is 25 percent cheaper than rubber lined or stainless steel and will save up to 50 percent of the installation cost. Engineering detail work for rubber lined pipe and fittings is eliminated.

Hills-McCanna Appoints New Representatives

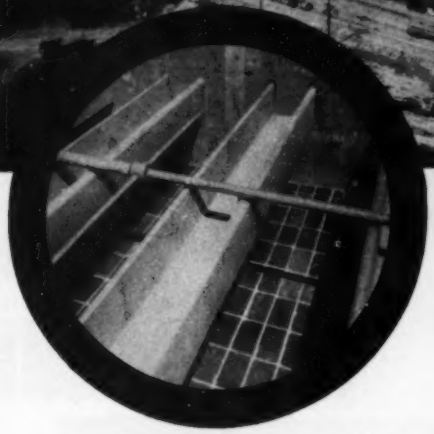
Hills-McCanna Co., Chicago, Ill., has announced the appointment of two new sales representatives in New England.

Power Specialties Company, 179 Oakley Road, Belmont 78, Massachusetts, under the direction of Mr. John R. Greenhalgh, has been appointed to represent Hills-McCanna in Maine, New Hampshire, and Vermont. Mr. Greenhalgh is well known in the paper, textile, rubber, and plastics industries in this area as the representative of The Johnson Corporation and Clark Mfg. Co.

Kenneth H. Greene, 80 Boylston Street, Boston, Massachusetts, has been appointed Hills-McCanna representative for Massachusetts and Rhode Island and for Albany, Rensselaer, and Schenectady counties in the State of New York. Mr. Greene is a graduate mechanical engineer and, in addition to Hill-McCanna, represents Pacific Pump, Lawrence Pump and Machine, and Dings Magnetic Separator.

Every man has a right to his own opinion, but no man has a right to be wrong in his facts.

Aerial view of new water purification plant, City of Houston, Texas. Freese, Nichols and Turner—Consulting Engineers. Brown & Root, Inc.—General Contractors.



Close-up photograph showing part of Leopold Filter Bottom installation in Houston Plant, prior to the placement of the filter media.

HOUSTON SELECTS LEOPOLD Filter Bottoms for New Water Plant

Constructed at a cost of $5,000,000, the new Water Purification Plant of Houston, Texas, combines many of the latest developments in industrial design with time-proven principles of municipal water treatment. Initially equipped for a capacity of 33 MGD, these up-to-date facilities are built to handle a nominal capacity of 50 MGD and are capable of efficient operation up to 200% of these capacities.

In addition to their use in this ultra-modern plant, Leopold Tile Filter Bottoms are giving dependable, economical service in over 250 plants with a daily capacity of more than 1¼ billion gallons. If you're looking for an economical solution to your underdrain problems, it will pay you to consider all the advantages offered by Leopold. Why not write us today for details.

Check these features of the LEOPOLD Filter Bottom:

- No possible corrosion or tuberculation anywhere in filter bottom
- De-aired fire clay blocks are practically non-absorbent
- Equal filtration; also equal distribution of wash water over entire bed
- Requires only shallow depth of small-sized filter gravel
- Long life, efficient performance

Leopold

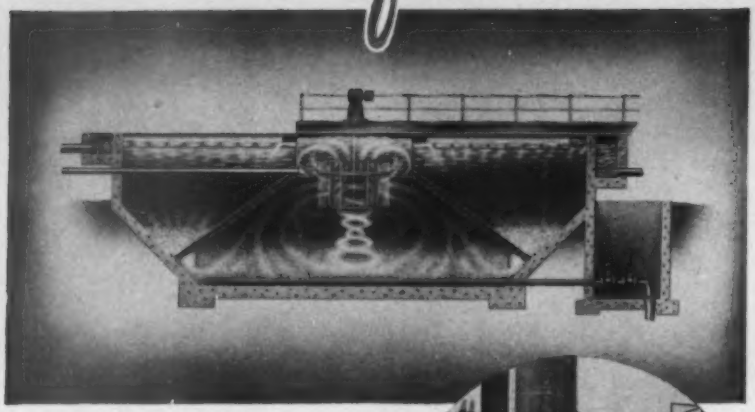
F. B. LEOPOLD CO., INC.

2413 W. CARSON STREET, PITTSBURGH 4, PA.

COMPLETE WATER PURIFICATION AND SEWAGE PLANT EQUIPMENT • DRY CHEMICAL FEEDERS
FILTER OPERATING TABLES • MIXING EQUIPMENT

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

an AMERICAN *first!*



AMERICAN

3 *stage* REACTORS

are more effective

softeners and clarifiers

For softening or clarification of surface water for industrial and municipal applications, American Reactors are unequalled in removing hardness, suspended solids, turbidity, color, taste and odor.

The American Reactor is a unique three-stage design in which the influent and reagents are actively agitated with pre-formed precipitates in the first stage. Agitation in the second stage is reduced and carefully controlled for ultimate coagulation and agglomeration, and in the third stage, stilling baffles further reduce agitation, providing ideal conditions for hydraulic separation of the floc and sludge.

By maintaining careful control of the hydraulic conditions affecting flow distribution, more effective removal of the contaminants is assured. This results in an effluent free from suspended matter, regardless of surge load conditions which upset other designs.

First in efficiency, American Water Conditioning Equipment is a result of over half a century of experience in the water conditioning field. Call or write today if you have a water problem.

SERVICE SINCE 1902 — AWSCO — TO THE INDUSTRY

AMERICAN *Water Softener* COMPANY

INCORPORATED

FOURTH AND LEHIGH AVENUE • PHILADELPHIA 33, PENNSYLVANIA

DEGASIFIERS • HOT PROCESS SOFTENERS • REACTORS • FILTERS • ZEOLITE SOFTENERS • CHLORIDE DEALKALIZERS • AERATORS & DEGASIFIERS HYDROGEN SODIUM ZEOLITE SOFTENERS • DEMINERALIZERS • CHEMICAL FEEDERS • CONTINUOUS BLOWDOWN • SWIMMING POOL EQUIPMENT

Literature & Catalogs

Tray Belt Filter

513

Hardinge Company, Inc., York, Pa., has just published a four-page folder describing a new and radically designed dewatering filter, known as the **Hardinge Tray Belt Filter.**

The bulletin includes complete operating details as well as a discussion of the applications and operational advantages of the new filter over conventional types.

Industrial Products

514

Johns-Manville, New York, N. Y., has issued a new edition of its 40-page **Industrial Products Catalog** which offers essential data on the following groups of products: Insulations, Refractory Products, Asbestos Cement Pipe, Packings, Gaskets, Electrical Products, Frictional Materials, Roofing, Siding, Flooring, Partitions, and Ceilings.

Photographs, diagrams, and text have been revised and brought up-to-date so that engineers and plant executives will have the latest information in a compact catalog that is easy to use.

Measuring Flow and Liquid Level

515

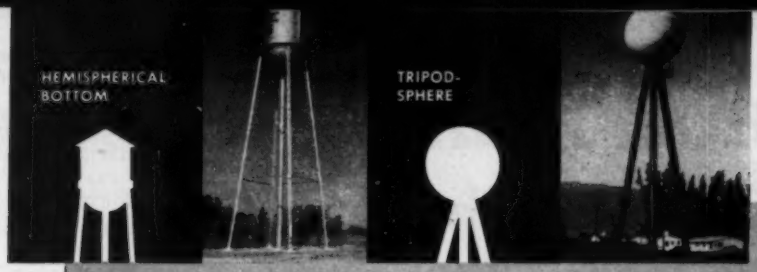
Minneapolis-Honeywell Regulator Company, Philadelphia, Penna., has just published a twenty-four page Bulletin describing a dozen different Honeywell systems for **Measuring and Controlling Liquid Level.** The bulletin contains brief general sections on measurement, transmission and control; also handling of difficult liquids. Also included is a two-page tabulation of twelve systems for quick comparison.

Process Control Instruments

516

Fischer & Porter Co., Hatboro, Penna., has just published a new catalog describing **Process Control Instruments** available for immediate shipment from its offices in Hatboro, Chicago, Dallas, and Los Angeles. The two-color, 20 pg. catalog lists a variety of flow meters, recorders, controllers, pressure regulators, sight flow indicators, and chemical feeders, giving discounts from list price as well as additional quantity

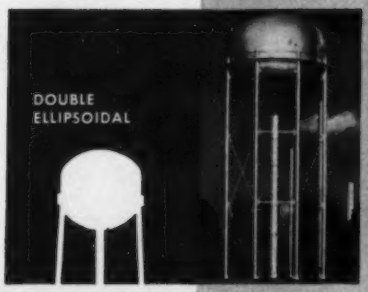
(*Continued on page* 128A)

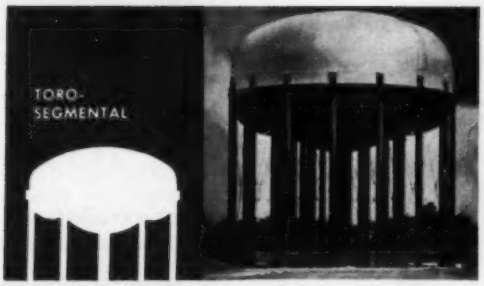


PITTSBURGH • DES MOINES

designs, fabricates and erects

every type of ELEVATED STEEL TANK for every WATER STORAGE need





The widely-varying water storage requirements of American communities are covered effectively by the broad range of Pittsburgh-Des Moines Elevated Steel Tanks available today. For every consideration of capacity, appearance, service, and cost, a corresponding answer is found in our standard and special elevated tank construction. Consult us on your water storage problems—our more than fifty years of experience in this field are at your service, without obligation.

Send for our helpful 20-page brochure, "Modern Water Storage in Elevated Steel Tanks" — free, complete, informative!

PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH (25) . . . . . 3418 Neville Island
NEWARK (2) . . . . . 218 Industrial Office Bldg.
CHICAGO (3) . . 1222 First National Bank Bldg.
LOS ANGELES (48) . . . . . 6399 Wilshire Blvd.
DES MOINES (8) . . . . . 919 Tuttle Street
DALLAS (1) . . . . . 1223 Praetorian Bldg.
SEATTLE . . . . . 526 Lane Street
SANTA CLARA, CAL. . . . . 625 Alviso Road

STEEL RESERVOIRS

If you are interested in water storage at natural elevations, write for our illustrated "Steel Reservoirs" Bulletin, sent gladly on request.

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

THOROSEAL *Restored* this Filtration Plant

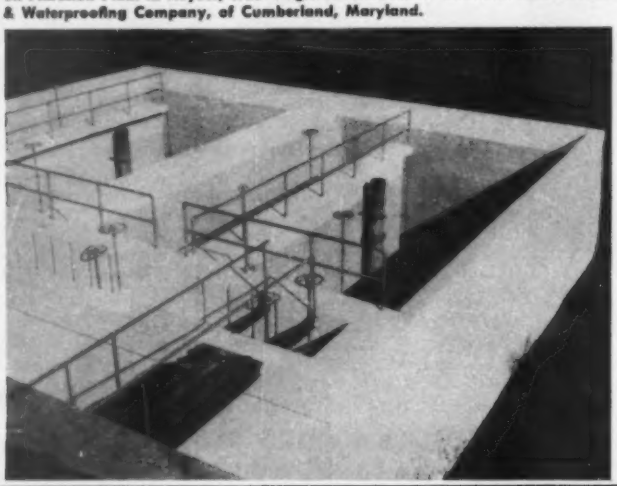
BEFORE

Example of complete break-down of masonry, due to penetration of water into body of concrete and action of frost in damp masonry.

It is amazing how THORO System products will correct a condition, such as shown in photograph. Concrete was sandblasted to remove all disintegrated material to sound concrete surface and reinforcing rods. Patching was done with THORITE Patching Mortar, bringing blistered areas to true and even lines, followed by two applications of WHITE THOROSEAL for protection.

AFTER

At minimum cost, almost ⅓ the cost of other methods, concrete restoration, patching and surface protection was completed with THORO System products on Filtration Plant in Keyser, West Virginia. Contractor: Standard Construction & Waterproofing Company, of Cumberland, Maryland.



WATERPLUG	THOROSEAL	QUICKSEAL
To Stop Leaks	To Seal Surface	For Beautiful Finish

Our 20-page Brochure describes, in detail, how The THORO System products can benefit you in your construction plan. Send for brochure today, which shows methods of application and how to use the material.

Standard Dry Wall Products

Box X, NEW EAGLE, PENNA.

(*Continued from page* 126A)

discounts. Complete instrument specifications are clearly set forth. Sizing nomographs for the two most common types of Flowrator meters are also given covering both liquid and gas service.

Automatic, Dry Feed, pH Control Systems

517

Minneapolis-Honeywell Regulator Company, Philadelphia, Pa., has just published an Instrumentation Data Sheet on **Dry Feed System For pH Control** that describes a complete system for continuous, automatic pH control of liquids in process including slurries, industrial wastes and clarified solutions. The systems are specifically designed for use with dry chemical feeders and include pH electrode and amplifier assemblies and ElectroniK indicating and recording potentiometers with pneumatic control. A schematic diagram of one installation is included with illustrations of component parts.

Electric d/p Cells For Level and Flow Measurement

518

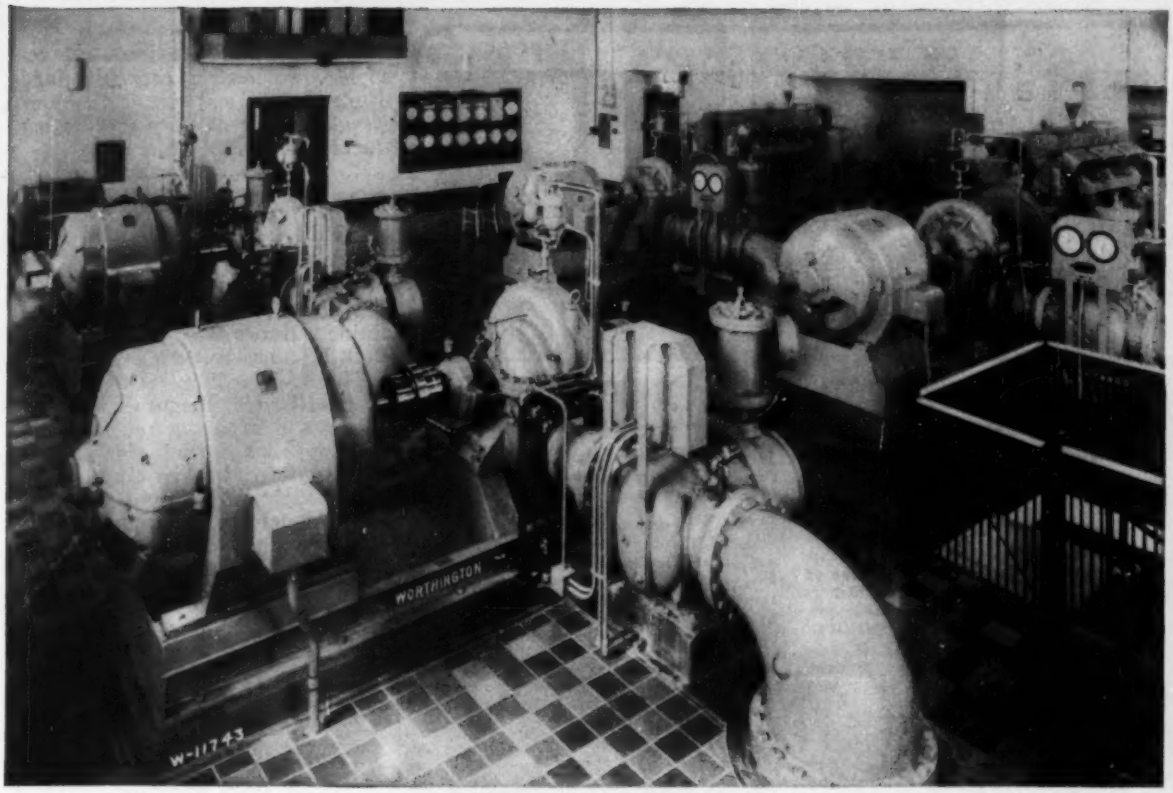
The Foxboro Co., Foxboro, Mass., has just issued a new, six-page **Technical Information Sheet** that describes electric d/p cell transmitters, which translate small differential pressures into electrical measurements of flow or level for instrument recording or control.

Construction details of the cells are explained, with cutaway illustrations to show how a metal diaphragm, responding to differential pressures caused by flow or level, applies force through a bar and strain tube arrangement. Electrical measurement of this force is accomplished by strain gages and received by a Foxboro Dynalog instrument, calibrated in units of flow or level.

Three typical applications of the cell are stressed: measurement of oil pipeline flow transmitted up to 2000 feet with high speed of response; flow or level transmitted any desired distance by the cell and a telemetering system; and high speed laboratory measurements in such fields as jet engine testing and flow analysis.

Helpful in determining the suitability of electric differential pressure transmitters to specific process conditions is a list of cell specifications, including the different types of diaphragm materials available and the various ranges obtainable. Also included are static and over-

(*Continued on page* 130A)



AS MODERN AS YOU'LL SEE ANYWHERE is this clean tile brick pump building at Evanston, Illinois, Water Works. At the left are three High Lift pumps—6-mgd, 8-mgd and 15-mgd—driven by Electric Machinery motors. At right are two 10-mgd High Lift pumps dual-driven by 350-hp E.M. motors and gasoline engines. Three other 125-hp Wash Water pumps are not shown.

Evanston Water Works— First on the North Shore— boasts modern Worthington-equipped pump room

In the 1890's, it was Evanston, Illinois, that set the pace in water works facilities along the North Shore with the first filtration plant.

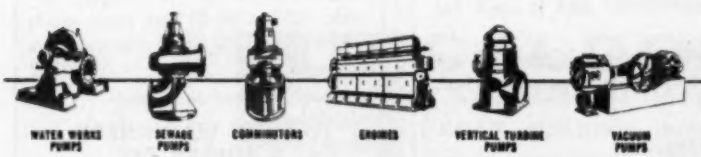
Today, this famous midwest city is still known by municipal engineers everywhere for its modern and efficient water-supply installation. The pump room pictured here is a vital part of these facilities.

Built in 1949, the new building houses eight motor-driven Worthington centrifugal pumps including three 10-mgd Wash Water pumps and three High Lift pumps—one 15-mgd, one 8-mgd and one 6-mgd. Two 10-mgd High Lift pumps are dual-driven. The complete water works installation was engineered by Alvord, Burdick and Howson of Chicago, Illinois, Consulting Engineers.

You'd naturally expect cities like Evanston, with reputations for the best in water works facilities, to demand the best in pumping equipment. Their choice is proof that *there's more worth in Worthington*.

Write for full details on Worthington's complete line of water and sewage works pumps and other public works equipment. Worthington Corporation, Public Works Division, Section W.2.1, Harrison, New Jersey.

W.2.1

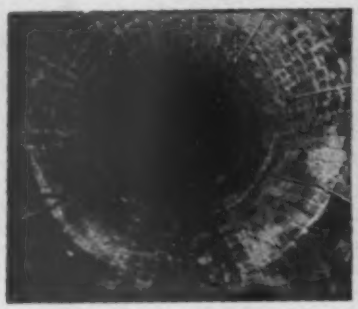


All Major Public Works Equipment Under One Responsibility

WORTHINGTON

Public Works Equipment

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.



"GUNITE" STRENGTHENS EXISTING SEWERS

Reinforced "GUNITE" lining has been successfully used on brick, tile and concrete sewers, restoring them to greater than originally designed strength.

Erosion of mortar joints and dislodged bricks made many sections of the above 65-year-old brick sewer in Illinois both dangerous and inefficient. We placed a reinforced "GUNITE" lining of varying thickness in this sewer without opening the streets.

Sewer service was maintained by installing temporary flumes and also by by-passing through relief sewers.

This job, and many other types of "GUNITE" jobs which we have done, are illustrated and described in our new 64-page general bulletin C2400. A request on your letterhead will bring you a free copy by return mail.

We will be pleased to cooperate with you on any of your problems.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES – ALLENTOWN, PA., U. S. A.

MANUFACTURERS OF THE "CEMENT GUN"

NO OTHER PIPE JOINT *Can Equal* BOND-O

- *In First Cost*
- *In Uniformity*
- *In Performance*

A careful survey of pipe joint costs will surprise you as to how much you can save with BOND-O. The low installation cost as well as a perfect performance record proves that nothing else equals BOND-O.

This self-caulking compound is accurately formulated and is used for jointing cast iron bell and spigot pipe.

Machine-blended by a unique process, BOND-O makes joints that are uniform and trouble-free. No BOND-O failure has ever been reported.

Write for literature today.

NORTHROP & COMPANY, INC.
SPRING VALLEY, N. Y.

(*Continued from page* 128A)

range pressure limits, frequency response, volumetric capacities and displacements, and circuit diagrams showing methods of compensating the cells for temperature effects.

Caterpillar Tractors and Pipe Laying

519

Caterpillar Tractor Co., Peoria, Illinois, has just published a booklet entitled, **Here's Why You Find Cat-Built Machines on So Many Spreads.**

The booklet discusses the importance of control, teamwork, dependability and safety in the machines working on a spread. Included in the easy-to-read folder-type booklet are 20 vivid photographs of Caterpillar diesel-powered equipment in pipe laying operations "all along the line," which include ditching, bending, lining up, welding, cleaning and priming, coating and wrapping, lowering in, and backfilling and cleaning up.

Complete Trencher Line

520

The Cleveland Trencher Company, Cleveland, Ohio, has just published a new bulletin describing the complete line of **Cleveland Trenchers and Backfillers.**

Inside spread of the 4 page bulletin has been arranged to permit a simple, quick comparison of the digging capacity and specifications of the Cleveland Trencher Models 92, 95, 110 and 140, the standard machines for city and suburban utilities and pipeline trenching from 10" to 30" wide and up to 5½ ft. deep. Text briefly describes specific advantages, typical job applications, and special Cleveland construction features of each model.

The unique Cleveland Model 80 Backfiller—Side Crane—Tamper is also treated on the spread. Action photographs graphically illustrate the Clevelands at work on different trenching jobs.

(*Continued on page* 132A)

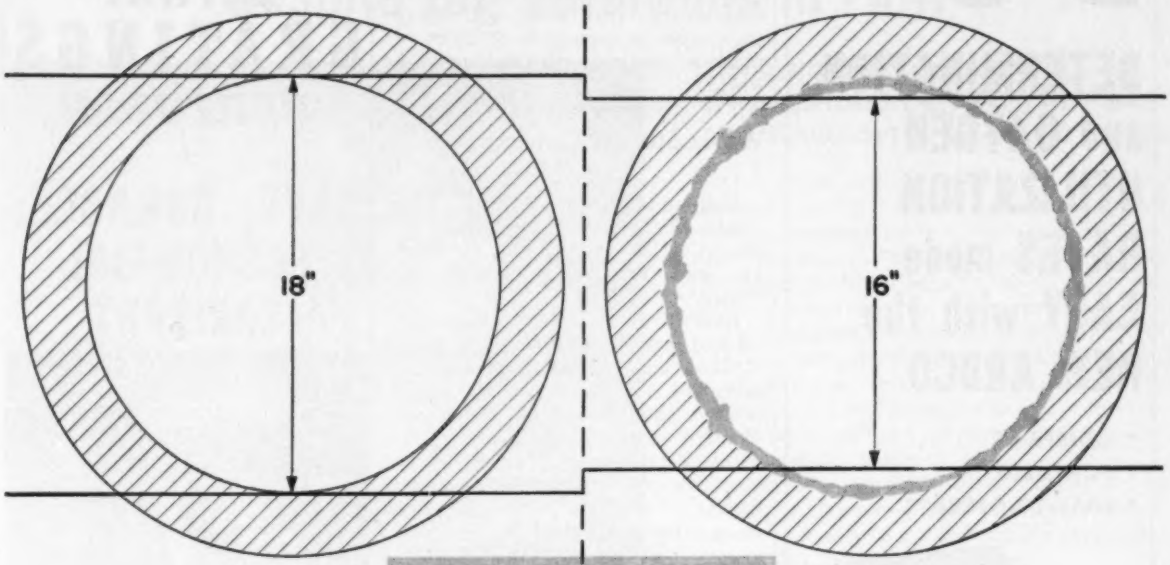
FOR SALE

1—Cleveland Model 110 trencher, 16" tracks, 16" buckets, 21" cut, presto shanks and tips. Used 100 hours—new guarantee $8000.00

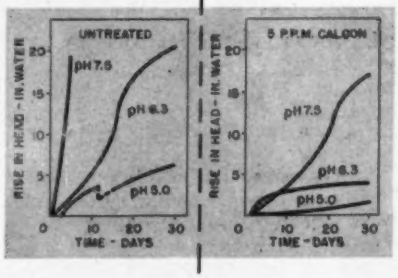
Discount to Dealers

WILSON MACHINERY & SUPPLY CO.
Lexington, Kentucky
Telephone No. 3-1455

CORROSION CONTROL FOR WATER MAINS



Tuberculation not only results in permanent damage to the pipe, but restricts carrying capacity drastically.



In this case, flow in this 18" pipe was reduced from 4.8 mgd to 3.3 mgd by tuberculation within several months. The effective diameter of the 18" pipe was therefore reduced to only 16".

Calgon*

greatly reduces tuberculation ... more than pays for itself

A rapidly growing eastern municipality found that, due to tuberculation, the 18" main carrying their principal raw water supply had to be cleaned as often as three times a year. After each cleaning, despite treatment with lime and chlorine, the restored flow dropped off rapidly from 4.8 mgd to 3.3 mgd, at which point the main had to be cleaned again.

Then Corrosion Control with 3.0 to 3.5 ppm of Calgon was instituted, and rate of flow held up so well that now the main is cleaned only once a year. A substantial reduction in cleaning costs, but this saving is only part of the story. In addition, this municipality has realized a saving of over $40 per day in pumping costs, and no red water complaints have been received since Calgon treatment was instituted.

Corrosion Control with Calgon is effective against tuberculation, and stabilizes dissolved iron and manganese. Corrosion Control with Calgon† is simple, effective, *and* economical. Let us tell you how Calgon can help you with *your* water problem.

HAGAN HALL BUROMIN CALGON

CALGON inc.

A SUBSIDIARY OF HAGAN CORPORATION

HAGAN BUILDING, PITTSBURGH 30, PA.

*Calgon is the registered trade mark of Calgon, Inc. for its vitreous phosphate products.

†Licensed under U.S. Pat. No. 2,337,856.

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

D O

DETERMINATION and OXYGEN UTILIZATION RATES made EASY with the NEW ARDCO

- COMPACT
- PORTABLE
- EASY-TO-OPERATE

MOD. 535

270.00

Cut down time and save operating costs on your disposal plant! Use the new Ardco for D O determination and oxygen utilization rates for the most efficiency. The new Ardco Model 535 is battery operated, making it completely portable and ideally suited for laboratory and field work. It will measure any ion capable of being reduced. With a few minutes instruction, anyone can operate it. Knob controls permit the selection of working voltages up to 3 volts and current multiplications to 24 micro amperes. Write for complete information.

GENERAL LABORATORY SUPPLY COMPANY

(*Continued from page* 130A)

Page 4 features Cleveland's big pipeline team — the Model 320 trencher and the Model 190 Backfiller. Copy outlines reasons why contractors are using Cleveland equipment on thousands of miles of pipeline projects throughout the world.

Water Storage Catalog

521

Hammond Iron Works, New York, N.Y., has just published an attractive 20-page catalog on **Storage and Processing Vessels for Water.**

Every type of water storage vessel and several installations of purification and filtration plants are described and illustrated. In addition to photographs of standpipes, elevated storage tanks, steel reservoirs, filtration and purification installations, the catalog includes details of designs, tables denoting sizes, capacities, etc.

Data On Light-Weight Pipe

522

Naylor Pipe Company, Chicago, Ill., has just issued a new bulletin showing typical applications of its light-weight **Lockseam-Spiralweld Pipe** and fittings. Included are standard specifications on pipe from 4 to 30" in diameter, together with data on fabricated fittings, flanges, and connections to meet all pipe line requirements.

Chemical Pump Catalog

523

Philadelphia Pump and Machinery Company, Wynnewood, Pa., offer a new 12-page bulletin describing their simplex and duplex reciprocating plunger **Controlled Capacity Pumps** for pressures to 20,000 lbs. and capacities from a few cc per minute to over 900 gallons per hour.

(*Continued on page* 134A)

WANTED WATER WORKS SUPERINTENDENT

"Accepting applications for position of water works superintendent in a small community in a Mid-Atlantic State. Applicant must have a first class water plant operators certificate. Salary, $450-$500 a month. Send references and particulars to Box 1121, Water & Sewage Works, 185 North Wabash Ave., Chicago 1, Illinois."

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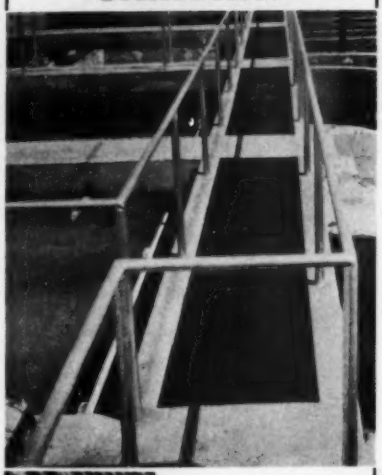

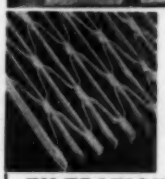

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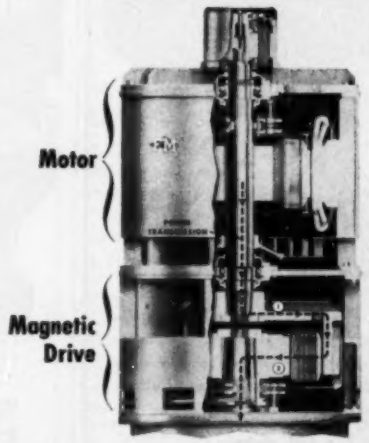

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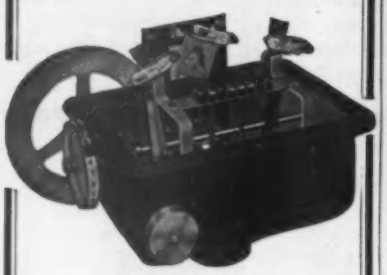

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(*Continued from page* 132A)

Included in this bulletin is information on the standard stainless steel, spring-loaded double-ball check valve as well as the SAF-T-KLEEN Valve, ideal for slurries, corrosives, food products, etc.

According to the bulletin, the capacity control mechanisms include the conventional rocker-arm micro-adjustment and the patented PHILATROL mechanism which permits manual or automatic pneumatic, hydraulic, or electric control, giving infinite, continuous regulation of capacity while running, from zero to maximum of the pump's range. The latter control mechanism operates in accordance with rate of flow, pH value, liquid level, temperature, pressure, conductivity or any other factor which instruments are made to meter.

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Simplified Water Supply Testing

524

The Federation of Mutual Fire Insurance Companies, Chicago, Ill., has just published a booklet **"Simplified Water Supply Testing."** Written specifically for fire departments, municipal waterworks officials, and for fire insurance company engineers, the booklet outlines practical procedures for testing approximate flow in water mains.

"Postwar migration of business and industry to new suburban districts has aggravated the problem of maintaining in water mains a flow sufficient for fire-fighting purposes," it was pointed out by D. K. Auck, the organization's director of fire protection engineering. "In many cases such expansion has outrun the waterworks capacity available. And yet the danger is not widely understood because it can only be measured by testing, and in many such areas equipment and personnel for making comprehensive tests may be lacking."

"Simplified Water Supply Testing" stresses that in many situations an approximate rather than an exact measurement of water flow is all that is required. The booklet describes a step-by-step method of conducting a hydrant flow test in areas where water supply is suspect, and explains the simple hydraulic computations needed to extend the test results and to interpret them correctly.

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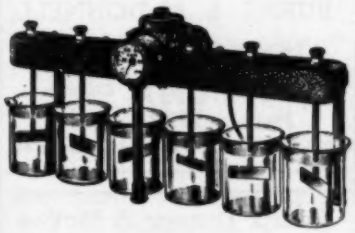

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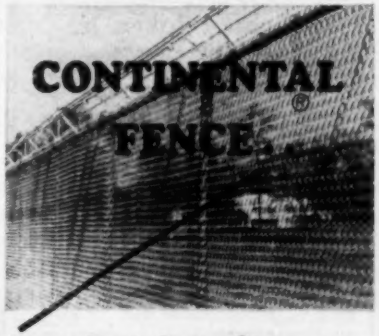

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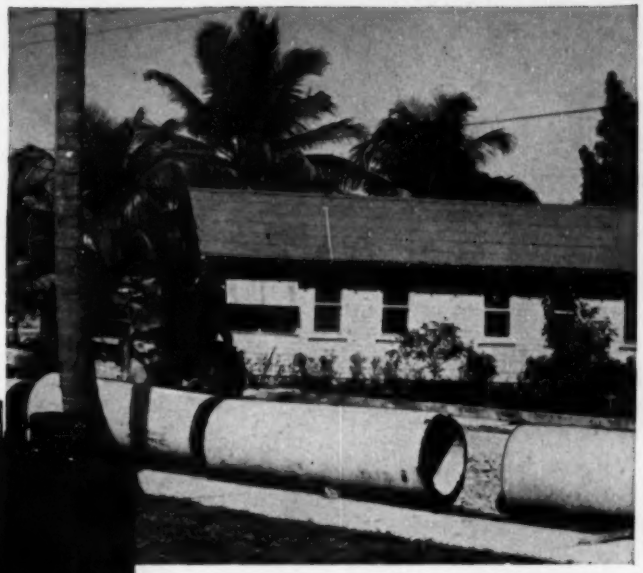

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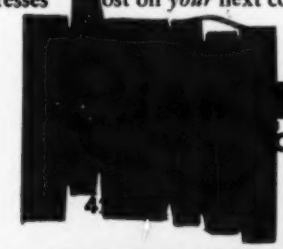

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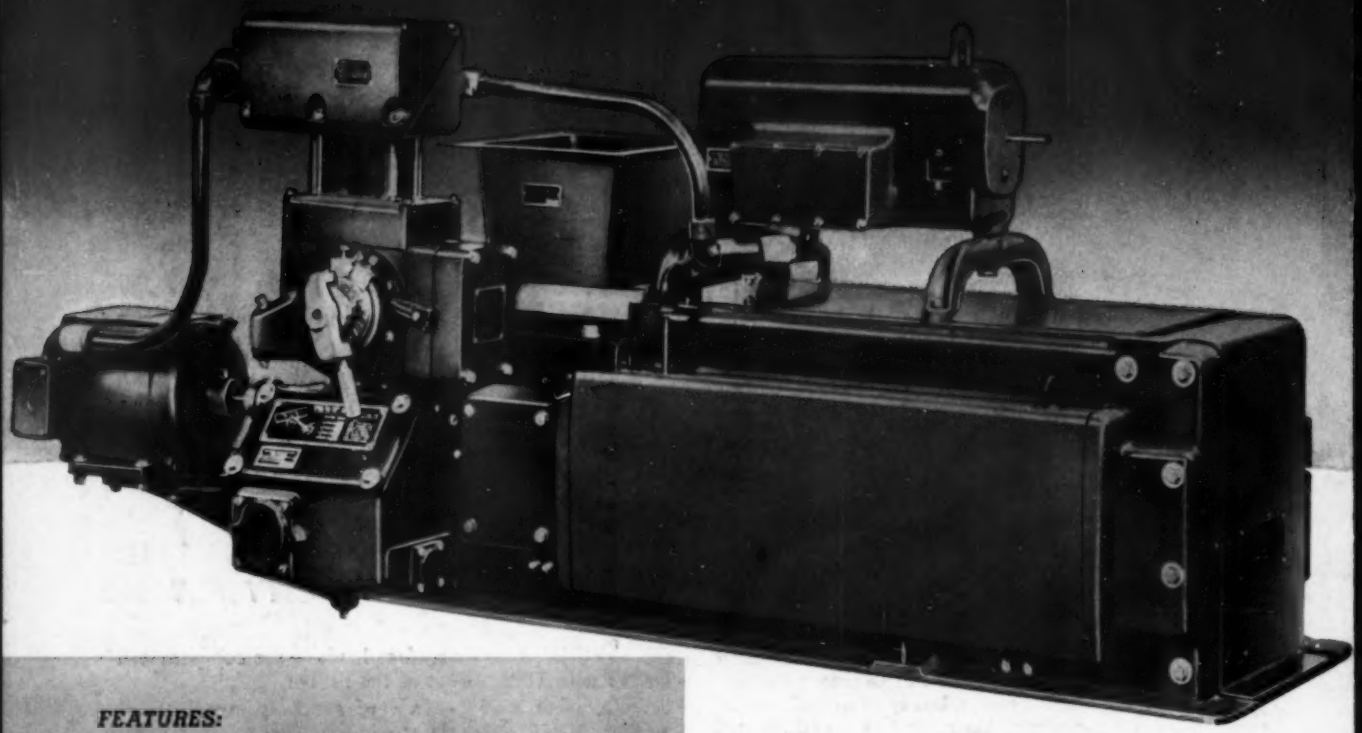

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